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INTRODUCTION

The Easter lily bulb industry is facing increased losses from nematode damage. This damage is occurring because of the declining number of effective nematicides registered for use on lily bulbs. This decline is due to ground water contamination and other environmental problems that have resulted in the non-renewal of registration, deletion of specific pesticide uses on bulbs or, in the North Coast region, cancellation or suspension of use of pesticides formerly used to control nematodes. The loss of products has caused much concern among growers. Recent losses of products include 1,2-dichloropropane (D-D* or 1,2-D) in the early 1980's, aldicarb (Temik*) in 1984, fenamiphos (Nemacur*) in the late 1980's and 1,3-dichloropropene (Telone II*, or 1,3-D) in 1990. Furthermore, registrants are reluctant to test other nematicides because the cost of registering new uses is not justified for a relatively small acreage of lily bulbs. At this time few nematode control options exist and positive research results have not kept pace with grower needs.

This report provides an overview of the Easter lily bulb industry, summarizes grower practices, and presents Integrated Pest Management (IPM) options for maintaining a healthy Easter lily industry in Del Norte County, California. The Department of Food and Agriculture (DFA) is identifying these options, but which have not been evaluated, as part of its role to promote and protect agriculture and to promote the implementation of pest management systems with the least possible harm to workers and the environment (Food and Agriculture Code (FAC), Sections 401 and 11501).

INDUSTRY

Overview

The Easter lily, Lilium longiflorum, is a traditional potted plant sold primarily at Easter time in the United States (US) and Canada. The Easter lily has been grown along the North Coast of California and South Coast of Oregon since the late 1930's. Prior to this time Easter lilies were imported from the Bahamas and Japan. A US trade embargo on Japan required the nursery industry to find a new supply of bulbs. In the 1930's and 1940's, Easter lilies were grown throughout the US, but, because of cost effective production practices, are now grown only in Curry County, Oregon and Del Norte County, California. In these counties, about 600 acres are planted to Easter lilies each year, with over 1800 acres in pasture for future lily rotation. In California, about 400 acres per year are planted with Easter lilies for a total gross income of over \$4.5 million (Appendix A).

Easter lily bulbs are grown for as many as four years before they are sold to nurseries throughout the US and Canada for potting and 'forcing' for sale at Easter. Forcing is the act of manipulating

environmental conditions to have bulbs flower when needed for marketing purposes. Forcing is undertaken by nurseries that have purchased bulbs from the North Coast growers. Nurseries force bulbs by exposing them to cold temperatures for a required number of hours at a time of year that will cause bulbs to flower for sale at Easter. The retail market for Easter lilies lasts about ten days just prior to Easter. Easter lilies are an ideal crop for the forced bulb industry to handle because production falls between the poinsettia market at Christmas and the potted or cut flower market in spring. The lily variety preferred by the industry is the 'Nellie white' because it produces 5 to 7 large blooms on a compact plant. Other varieties produced elsewhere, primarily Japan and the Netherlands, are not acceptable for the potted flower market. These varieties are for cut flowers. Nurserypersons in Japan and The Netherlands are continuing to look for new varieties and new markets, possibly to compete with the north coast industry.

Because of importance of bulb production in The Netherlands and increasing government regulations to deal with pollution problems, it can be anticipated that considerable effort will be put forth to mitigate these problems. What the Dutch learn may be useful in mitigating North Coast problems. Growers in The Netherlands use the same chemicals that the North Coast producers use for soil treatment and control of nematodes. These chemicals are under scrutiny by the Dutch government because of contamination problems and are likely to be restricted in some fashion in the near future. The Netherlands government issued EG-directive 80/778 on July 15, 1980 which set the standard for the maximum permissible content of the total quantity of pesticides in drinking water at 0.5 µg/l. A maximum of 0.1 µg/l applies for each individual substance. If these substances are not removed by ground water treatment methods, then these maximum permissible contents also apply to raw ground water. In addition, The Netherlands government policy is aimed at preventing the presence of these substances in the drinking water as much as possible (Metz, 1989). Hopefully, strategies developed in The Netherlands to protect ground water can be similarly researched and applied on the North Coast.

Value to Del Norte County

Easter lily bulb production is an important and integral part of Del Norte County's economy. Gross revenue from the production of Easter lilies has steadily grown to \$4.5 million (Agricultural Commissioner, 1989). This industry employs about 150 seasonal persons and 15 to 20 full time persons. Easter lilies represents 28% of the agricultural production for the county, excluding timber. Irrigated pasture (1,600 acres), and dairy and beef cattle, which are an integral part of lily bulb production because of crop rotation practices, produced between \$1-2 million in gross revenue for the county.

In the early fall, brokers from across the country converge on the North Coast to buy bulbs. Brokers purchase bulbs based on size

(from 7 to usually 11" in circumference) and quality. Quality is judged by visual means, looking for white bulbs with plentiful roots.

Pacific Bulb Growers' Organization

There are ten growers in the Pacific Bulb Growers' Organization (Appendix B). Growers currently assess themselves \$1.00 per case for support of the research program. In 1989, approximately \$43,000 was raised for research from the California bulb production and \$25,000 from Oregon production. Most resources for research are directed to nematode control.

In the 1950's, Oregon State University (OSU) in cooperation with the United States Department of Agriculture (USDA) and the University of California (UC) established a small research station in Brookings, Oregon where Easter lily bulb research is conducted. Currently, the Easter Lily Research Foundation (established by the Pacific Bulb Growers Association) leases the station and conducts research on pesticide efficacy, pesticide phytotoxicity, and cultural practices. Alternatives to pesticides are also researched.

LILY BULB CULTURE

Climate and Soil

Easter lily bulbs are grown on the Smith River plains and the coastal bench (an area north of the plains that is a sloping bluff to the ocean) in Del Norte County in California and Curry County in Oregon. Average annual rainfall recorded at the research station at Brookings, Oregon is 73 inches and soil temperatures (ten year average at six inches deep in bare ground) ranged from 45.6°F in January to 70.1°F in July (Riddle, 1986). The soils of the Smith River Plains within the top five feet are highly variable ranging from sandy loam to gravelly clay, including heavy loam (Warner et al., 1989). The soil pH is generally 5.0 before liming.

Cultural Practices

The land is prepared in May or June, summer-fallowed, and planted with bulbs from late August to mid-October. In the first year either bulblets (small, thumbnail-size bulbs) or scales (overlapping leaves that make up the bulb) are planted at the rate of 300 - 400 thousand per acre. After one growing season 'yearlings' (one-year old bulbs) are replanted in a recently prepared field at the rate of 60 - 70 thousand per acre (the same rate as commercial bulbs). At the end of the second season, if yearlings have reached a minimum of seven inches in circumference (number 7's), they are packed for shipping to nurseries; if smaller, bulbs are replanted for a third season. Some bulbs may be planted for a fourth year, however, this practice is not favored because of increase of pest problems.

Bulbs are harvested beginning in late August using a modified mechanical potato harvester and are sent to sheds in boxes for sorting. Proper sized bulbs are packed for commercial sale and shipped in refrigerated trucks to buyers and greenhouses throughout the US. Smaller bulbs are dipped in fungicide solution and replanted. Bulbs are graded by size and quality; white bulbs with healthy-looking roots are preferred.

Planting or replanting into former pasture land is standard practice. The land may have been in pasture from three to six years depending on grower practices and land availability. Because lily bulb production is considered hard on the land, rotating between bulbs and pasture will facilitate soil recovery from tractor-induced soil compaction and declines in soil pest populations.

Bulbs may be planted within 24 hours after digging or kept in storage for up to a week, depending on sorting and dipping schedules and completing preparation of the field to be planted. They are planted four to six inches deep into ridged beds facilitating drainage thereby reducing bulb diseases. Fertilization, irrigation, cultivation, and pest control occur during spring and summer. Blooms are removed to keep plants short, promote bulb growth, and facilitate cultivation.

Pests

The important pests (nematodes, insects, mites, diseases, and weeds) of Easter lily bulbs are: lesion nematode (Pratylenchus penetrans), foliar nematode (Aphelenchoides fragariae), melon aphid (Aphis gossypii), western lily aphid (Macrosiphum scoliopi), oat bird cherry aphid (Rhopalosiphum padi), English grain aphid (Sitobion avenae), bulb mite (Rhizoglyphus robini), cucumber mosaic virus, foliage blight (Botrytis spp.), root rots (Fusarium oxysporum, Pseudomonas gladioli, and Cylindrocarpon radicicola), and weeds, particularly annual grasses, common groundsel (Senecio vulgaris), and prostrate knotweed (Polygonum aviculare).

The lesion nematode has a broad host range of over 130 different genera of plants (Siddiqui et al., 1973). H. J. Jensen has stated that the lesion nematode is the most dangerous nematode pest in western Oregon, where it is associated with damage to bulb crops, nursery crops, and strawberry (Jenkins and Taylor, 1967). The lesion nematode may damage bulbs enough to increase the susceptibility of the plant to facultative pathogens, particularly Cylindrocarpon destructans (Maas et al., 1978). The infested plants turn yellow and die early due to root rot.

Aphids are significant because they transmit the viral causal agents of cucumber mosaic, tulip breaking and lily symptomless resulting in twisted plant growth, yellow flecking, cupped leaves, reduced vigor and increased susceptibility to other diseases (Riddle, personal communication).

The common mite pest of Easter lily bulbs is bulb mite, however there are divergent opinions on the pest status of this mite (Ascerno, 1981). North coast growers consider this mite a minor pest and do not treat specifically for it. Commercial operators, who sell potted lilies to retailers, have experienced losses that they attribute to this mite. However, there is a relationship between mites and root rots that is detrimental to lilies (Ascerno, 1983).

Bald, et al. (1983) surveyed Easter lily bulbs from the North Coast for various pathogens. Fusarium strains were predominantly isolated from plants treated with heat and pesticides, which may be due to resistance. These strains ranged in pathogenicity from almost non-pathogenic to those causing severe basal rot. They also found a complex interaction between Pseudomonas and Cylindrocarpum during infection and development of lesions. Other pathogens including Rhizoctonia solani, Pythium ultimum, and Sclerotinia sclerotiorum were present but may not be significant. As control options change, the relationship of these diseases to one another and to the lesion nematode are unknown. Growers are concerned that crop losses may be significant if major changes are made in their disease control strategy.

Major weed pests include annual grasses, common groundsel (Senecio vulgaris L.) and prostate or common knotweed (Polygonum aviculare L.). Weed control is preventive with the application of a pre-emergent herbicide in late winter or early spring. The herbicide cannot be toxic to the lilies which have been growing slowly since planting in the fall. Any weeds that escape the treatment are either hoed out or on occasion spot treated with a contact herbicide.

Current Control Methods

Pesticide Use and Control Alternatives

Pesticides are used to control nematodes, aphids, foliage blight, root rots, and weed pests (Table 1 and Appendix C). Before planting bulbs, the field is fumigated and bulbs are dipped in a fungicide bath. Fumigation kills many different kinds of pests, including weeds, nematodes, causal agents of diseases, and insects. Foliar nematodes and root rots are reduced substantially by a hot water, fungicide dip of bulbs before planting. At the time of planting, a granular pesticide is applied into the bulb furrow above the bulbs to control insects, nematodes and mites. The bulbs and pesticide are covered with soil. The next pesticide application occurs in January for weeds. Beginning in early spring, between 15 to 26 fungicide applications occur every 7 to 10 days depending on rainfall pattern. In late spring and summer, there may be three or four applications of an insecticide for aphid control. Finally, in summer, there may be herbicide spot treatments for weeds until harvest.

Since the lesion nematode is the key pest in Easter lily bulb culture, control options and cultural practices focus on managing it

first. Lesion nematode, because of its wide host range and presence in pasture land soil, requires control by soil fumigation prior to lily bulb planting. Replanted lily bulbs are also a source of nematodes necessitating pesticide application into the same furrow where the bulbs are planted to retard growth of the lesion nematode population. Phytotoxicity from certain nonfumigant nematicides has reduced the number of usable options at or post planting. A final measure employed by some growers to reduce initial nematode populations is to clip roots of bulbs that are visually heavily infested. This measure costs from one to two cents per bulb, but is only partially effective.

Melon aphid is the major aphid pest of lily plants because it transmits the causal agent of cucumber mosaic virus. Control is necessary whenever localized aphid populations develop. Generally, three insecticide treatments are made to the entire field in late spring and summer. Aldicarb provided some residual aphid control but since it is no longer registered for use on Easter lilies, more frequent insecticide treatments are necessary. Western lily aphid and other aphids are controlled with insecticides at the same time treatment is made for melon aphids. Pests that do not cause problems under the current IPM program include lily weevil (Agasphaerops nigra) and bulb mite. However, bulb mite can be a problem in 'forced' bulb production.

The cool, moist conditions of the North Coast favor foliage blight. This disease is controlled routinely with several fungicides. Applications occur roughly every seven to ten days throughout the growing season. The fungicides are usually rotated, alternating copper sulfate with tank mixtures of copper hydroxide and chlorothalonil. Spreader/stickers are also incorporated into the tank mix. On occasion the application is interrupted by rainfall; treatment resumes as soon as growers can get back into the field. With the high number of tractor trips through the field, growers feel that this activity places the field under 'high stress' from soil compaction, and that crop rotation allows the field to 'recover'.

With the exception of fumigants growers apply pesticides themselves. Fumigation with methyl bromide or metam-sodium requires specialized equipment and is performed by commercial applicators. Equipment for application of other pesticides is owned by the growers and gives them the flexibility to treat when needed without relying on a commercial applicator. Applications may occur any time during the day, even late in the evening on days after planting is completed.

Since growers apply pesticides themselves and are responsible for worker training, there is reluctance to use what growers perceive to be hazardous chemicals. One grower was reluctant to use methyl bromide, even though a commercial applicator would be responsible for application.

Growers also make all IPM decisions. They monitor for pests, make the identification, determine what control option to use, and when

to treat. Growers rely primarily on Lee Riddle, manager of the Easter Lily Bulb Research Station (publisher of a monthly newsletter with Research Station results) and California and Oregon farm advisers for IPM information. The farm adviser from Oregon, Steve Morgan, has been recently testing control methods for aphids. There are no California licensed pest control advisers available in the area to provide IPM information to lily bulb growers.

Table 1. CONTROL AND POSSIBLE ALTERNATIVES

<u>CULTURAL CONTROLS FOR BULB PESTS</u>	
crop rotation	Effective, to reestablish beneficial soil organisms and soil health
scale production in vermiculite	Needs research, to grow roots without nematodes present
soil solarization	Partially effective, tarp problems, needs 60 to 90 days, weather too cool

PRE-PLANT SOIL TREATMENT

Control of Pests in Soil (Fumigation)

Fumigation is designed to control nematodes, soil-borne pathogens, and weeds.

methyl bromide	Effective, special application equipment needed
*metam-sodium (Vapam [•] , Sectagon [•])	Promising but erratic results
dazomet (Basamid [•])	Effective
1,3-dichloropropene (Telone II [•])	SUSPENDED

*Note: metam-sodium when sprinkler applied or drip injected is not effective; when it is shank injected, rototilled and rolled the results are promising.

NOT REGISTERED - means not registered for use on Easter lilies in Del Norte County.

Table 1 (cont.) CONTROL ALTERNATIVES

Nematode Control Only

Nematicides control or delay the development of lesion nematodes.

marigolds (<u>Tagetes</u> spp.)	Needs research, possible phytotoxicity
mustard cover crop	Needs research, partially effective

Note: control is from isothiocyanates found in mustard roots and leaves

BULB DIP TREATMENT (PRE-PLANT)

Plant Disease Control

Fungicides used to control soil-borne pathogens

benomyl (Benlate®)	Effective
PCNB (Terrachlor®)	Effective
thiophanate-methyl and terrazole (Banrot®)	Effective, may not be reregistered
thiram	Needs research
carboxin (Vitavax®)	Effective, registered as Special Local Need in Oregon

Insect, Mite, and Nematode Control

abamectin (Avid®) (Sasser et al., 1982)	NOT REGISTERED, being researched, promising
fenamiphos (Nemacur®)	NOT REGISTERED, being re- searched, phytotoxic, potential worker hazard
oxamyl (Vydate®)	Effective (Rijnders, 1990), questionable results on No. Coast (Riddle, 1991)
hot water dip for nematodes	Old method for foliar nematode, being researched for lesion nematode
pre-dip root clipping for nematodes	Cost effective when nematode damage severe and used with other nematode control methods

Table 1 (cont.) CONTROL ALTERNATIVES

AT PLANTING - IN FURROWInsect, Mite and Nematode Control

phorate (Thimet [•] , Rampart [•])	Effective, some phytotoxicity
aldicarb (Temik [•])	NOT REREGISTERED
fensulfothion (Dasanit [•])	NOT REGISTERED
terbufos (Counter [•])	NOT REGISTERED
ethoprop (Mocap [•])	effective, NOT REGISTERED
(Riddle, 1989; Warner & Gergus, 1990)	
cloethocarb (Lance [•])	NOT REGISTERED
thiodicarb (Larvin [•])	NOT REGISTERED, may have some nematicidal activity
isazophos (Triumph [•] , Miral [•])	NOT REGISTERED

Nematode Control only

fenamiphos (Nemacur [•])	USE WITHDRAWN
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Pesticide-related Options

latex cap over pesticide	Needs research, to divert water away from chemical and reduce potential to leach
slow-release granules	Needs research

POST- PLANTINGInsect Control

carbofuran (Furadan [•])	Effective
diazinon	Effective
acephate (Orthene [•])	Effective
disyston	Effective
dursban	Effective

Disease Control

chlorothalonil (Daconil [•])	Effective
copper sulphate & lime (Bordeaux)	Effective
copper hydroxide (Kocide 101 [•])	Effective
mancozeb	Effective

Weed Control

diuron (Karmex [•])	Effective
glyphosate (Round-up [•])	Effective
napropamide (Devrinol [•])	Effective, NOT REGISTERED

Cultural Pest Control

There are several non-chemical practices used to reduce the impact caused by pest problems. Varieties resistant to root diseases are used and planting bulbs into former pasture is practiced by all growers. These two practices minimize root disease problems. Bulb tops (plant residue before bulbs are dug) are disced into the soil in a field that will not be planted to bulbs for several years allowing time for decomposition before the next bulb crop is planted. During harvest, discolored bulbs and bulbs that are too small are discarded. Bulbs may have roots trimmed off and dipped into hot-water to reduce nematode numbers introduced into planting furrows. Weed control may be by either cultivation or hand hoeing during spring and summer. Finally, diseased plants are rogued from the fields during spring and summer to reduce inoculum of disease causal organisms.

Costs

Pest control represents a major cost to growers in lily bulb production, approximately \$1600 per acre per year based on cost of materials only for weed, insect, nematode and disease control and the total cost of fumigation application. The costs associated with field fumigation increased substantially this past season. With the loss of 1,3-D (treatment costs \$500 per acre), growers now use methyl bromide products (\$1200 per acre) or Sectagon II® (\$800 to \$900 per acre) resulting in an increased cost of \$300 to \$700 per acre.

Integrated Pest Management

Some simple relationships exist in the IPM of lily bulb pests. Bulb dips are site specific and control multiple pests. The crop rotation scheme reduces the need for nitrates and shifts the weed species population. Preplant soil fumigation reduces or controls many pests.

One of the relationships still not well understood is foliar disease control, its impact on soil-borne pathogens, and its relationship to the effect that nematodes have on the plants. Jenkins and Taylor (1967) in a general review of lesion nematodes state that root damage by lesion nematodes may serve as a pathway for invasion by pathogenic microorganisms. These openings in roots may be the primary effect of lesion nematode on plants. The possible relationship between root diseases and lesion nematode forms the basis for the crop protection strategy currently in place. Any procedure that may be limited in its control of nematodes and pathogens will be viewed with caution by the growers unless results are proven options for total control are presented.

Ascerno (1981 and 1983) discusses the relationship of root rot and bulb mites and concludes that suppression of high populations of

bulb mite on 'forced' lilies is a prerequisite for fungicidal control of root rots. Because of this pest relationship, forced-bulb growers are wary of any pest management change that may increase bulb mites. The Easter lily bulb brokers and forced-bulb growers are satisfied with the field-grown product.

The forced-bulb growers are able to meet market and quality demands, but must pay attention to bulb diseases and bulb mite. Nematodes are not a problem in the forced-bulb industry.

Several researchers have evaluated the implementation of IPM in agricultural situations (Wearing, 1988). Lambur et al. (1985) states that because IPM is complex, adoption takes more time than a unilateral chemical or simple cultural approach for control of a pest. IPM technology often relies on biological and ecological insight. Consequently, rediscovery of techniques must occur and growers may choose to adopt only a portion of the technology (Lambur et al., 1985). Lily bulb growers have supported research of some non-conventional techniques to obtain nematode control. This work involves the use of plants (marigolds and mustard) in rotation with bulb fields and improving a hot water treatment for bulbs. Even though research continues on IPM aspects and adoption of new procedures occurs by growers, financial resources will likely be a limiting factor in development and implementation of IPM.

Best Management Practices

Best Management Practices (BMPs) are commonly referred to in discussions about protecting ground and surface water from contamination from non-point sources (NPS), such as agricultural operations (Appendix E). BMPs are typically developed by government agencies and, in some cases, mandated on property owners where pollution has or is likely to occur. It may be necessary to develop specific BMPs which may apply to only one property. These BMPs may have to be developed by the individual property owner as a way of reducing the risk of contaminating water from his or her agricultural production activities. Whenever pesticides are detected in water there is the likelihood of restrictions on users of the pesticide in question to eliminate or significantly reduce the risk of water contamination. As restrictions are implemented, the pest control options are altered. The implementation of BMPs can be perceived as a cooperative procedure between government and industry for protecting the environment and maintaining agricultural productivity.

There may be confusion as to the relationship of BMPs to IPM. Agriculturalists commonly use the term IPM in the context of pest control and the term BMP in management of pesticides to reduce risk of contaminating ground and surface water. However, IPM and BMP activities are intertwined and should be considered complementary. For example, the Weed Science Society has a position statement supporting sustainable agriculture and encouraging IPM and BMPs as part of sustainable agriculture (Weed Science Society of America, 1990.)

Research

The growers have supported a research program by funding a full-time researcher and providing grants to other researchers. Aside from research on pest control options, efforts have been directed to tissue culture for nematode- and virus-free planting stock, development of new varieties, and seedling production. This program has, until recently, provided new production methods to maintain a profitable farming enterprise. However, the burden for funding additional research appears to be shifting to the growers and away from registrants and others, particularly when registrants are reluctant to test potentially useful nematicides because the cost of registering new uses for this small market is not justified.

Since Easter lily bulbs are a small specialty commodity, it is difficult for growers to support any costly, long-term research effort. The long production cycle (2 to 3 years for most bulbs) results in significant costs. Research efforts that reduce the production cycle would reduce pesticide use (on a pesticide per bulb basis) and costs. Any research project has to promise a reasonable potential return on investment; however, long term research is difficult to justify because benefits are not easily anticipated. For example, the lily bulb growers recently invested in equipment that would allow them to buy 1,3-D in bulk for use in a closed application system. The use of 1,3-D was suspended before the return on the cost of investment was realized. Growers are now more reluctant to invest in equipment unless the risk of financial losses are minimal.

Pressure to keep bulb prices low arises from the possibility that consumers would shift to other Easter flowers should prices rise disproportionately to other flowers. Once the market shift occurred, regaining lost sales will be difficult. Since prices cannot be increased, funds for research or other IPM activities would decrease grower returns in the short run until prices could be adjusted upward or returns realized from implementing research results.

Research results from other bulb-growing countries, particularly the Netherlands, may be useful in the long term. Because ground water contamination is an important issue in the Netherlands and in Europe research there on nematode control may lead to methods that do not contaminate ground water.

FACTORS AFFECTING IPM OPTIONS

Numerous laws, regulations, memoranda of understanding (MOU's), and policies influence the IPM options available to Easter lily bulb growers (Appendix F). Two types of recently passed laws have had a profound affect on lily bulb culture; the Pesticide Contamination Prevention Act (PCPA) enacted in 1985) and toxic air contaminants (TAC) laws enacted in 1983 and 1984.

Pesticide Contamination Prevention Act

The PCPA (FAC, section 13141 through section 13152) and California Code of Regulations (CCR), sections 6199, 6400, 6416 and 6417, 6486, 6570, 6572, and 6800 through section 6804 provides for mandatory submission of data regarding chemical characteristics of pesticide active ingredients that may be indicative of environmental behavior. The characteristics include water solubility, vapor pressure, octanol-water partition coefficient, soil adsorption coefficient, Henry's law constant, degradation (hydrolysis and photolysis), soil metabolism (under aerobic and anaerobic conditions), and field dissipation. This information can be used to establish a list of the chemicals with the potential to contaminate ground water and that DFA should monitor for in ground water.

Once a pesticide chemical has been detected and its presence confirmed in ground water, DFA also determines if the contamination was a result of agricultural use that was legal (Monk et al., 1987; Appendix F-6). In making that determination the chemical in question must be shown to be properly registered and used on a crop listed on the label. In practice, this determination is made when other potential sources of contamination such as the use of a chemical for non-pesticidal purposes, industrial uses, and improper disposal have been ruled out. The determination of agricultural use, as required by PCPA, can be made for pesticides registered by EPA under FIFRA section 3 (standard registration), section 24c (special local need), and section 18 (emergency use); and registered by California under FAC Chapter 2, Economic Poisons. It is unclear whether or not those products granted RAs, when used for pest control and subsequently detected in ground water, are deemed agricultural use and thus fall under the provisions of PCPA. Because an RA authorizes use, the product is being used legally. Until this is clarified, registrants will be reluctant to conduct research on pesticides in Del Norte County because a verified detection of residues in ground water could lead to possible restrictions on all products containing the detected chemical.

In the PCPA Draft Implementation Plan, staff proposed that certain detections be exempt from PCPA because under certain registered conditions, pesticide use could be easily terminated. These uses include emergency use (Section 18 of FIFRA) and most experimental uses (RA granted by DFA) (Monk et al., 1987). This approach was affirmed in regulation, but only for research conducted in Pesticide Management Zones (CCR Section 6417).

The experimental use exemption was also reflected in the Director's response to the PREC subcommittee's recommendations regarding aldicarb. The subcommittee had found that registrant's field tests in the Central Valley of California had demonstrated that aldicarb moved readily through these soils to ground water. In response, the Director stated that the subcommittee's finding was based, in part, on experimental results from field degradation and movement tests conducted by the registrant, and that it was inappropriate to use such experimental results for assessing the leaching potential of

currently registered uses of aldicarb. The tests were conducted under conditions of an RA which is issued prior to any experimental, unregistered use of a pesticide and must be obtained by registrants who are developing field data to support potential new uses of a pesticide. Additionally, data from these tests are used by DFA to evaluate new uses under the conditions specified and cannot be used to evaluate different uses under different conditions. The Director stated that experimental use and subsequent test results for aldicarb would not support registration for the experimental uses, and therefore, to use those research results to embark on a PCPA hearing process is not appropriate whenever a pesticide is found and confirmed in ground water (Voss, 1989).

If so, the pesticide registrants are notified and they may request a hearing. A hearing is conducted by representatives of the Department of Health Services, State Water Resources Control Board (SWRCB) and DFA. The detection of a pesticide in ground water in the Smith River area would subject the statewide use of the pesticide to review by these representatives. They review human health and environmental information and make recommendations to the director of DFA, including possible modifications of use or cancellation of the pesticide (FAC, 13150). The director then issues findings which affect the use of the chemical, and, in some cases, establishes areas, Pesticide Management Zones, where the use of the chemical is restricted (CCR, section 6802).

Chemical companies are reluctant to pursue registration of pesticides for use on Easter lily bulbs for two reasons: economic gain is minimal compared to the cost of registration and, because environmental conditions in Del Norte County favor ground water contamination, companies do not want to trigger review under the PCPA. They do not want their products entered in the hearing process that evaluates all uses of the pesticide on all crops and sites throughout the State for potential to contaminate ground water. In preparing for the PCPA hearing, pesticide registrants must spend considerable time and money to show that the chemical does not pollute or threaten to pollute ground water. The Smith River Plains are perceived as an area of high risk, and until chemical companies can be convinced to work with the industry on registering products, new chemical control options will be limited.

Pesticide Monitoring Results from the North Coast

Environmental conditions in the North Coast region are generally in line with those that favor ground water contamination, such as high rainfall and frequent irrigations, gravelly or sandy soil, shallow water table, cool temperatures, and acid soil conditions (Helling and Gish, 1986). Ground water has been sampled for pesticides for several years by the North Coast Regional Water Quality Control Board and the DFA. Pesticides associated with Easter lily bulb production have been found in ground water of the Smith River Plains, exclusively. No detections of pesticides in ground water have been made in Easter lily bulb growing areas of Oregon (Appendix

K) and no records of testing of California's North Coast bench ground water has been entered in the well inventory data base for 1986 through 1989 (Appendix L). Therefore, in evaluating any IPM strategy to protect ground water, it may be appropriate to treat the Smith River Plains differently than the coastal bench.

Although ground water monitoring had been occurring prior to passage of the PCPA, DFA has placed more effort on ground water contamination problems and there has been an increase in the numbers of nematicides monitored for during and samples taken in the last two years in Del Norte County.

Table 2. Summary of samples taken for pesticide residue analysis from wells in Del Norte County.

Year	Positive	Negative	Total
to 1986	497	333	830
1986-87	33	39	72
1987-88	0	20	20
1988-89	38	267	305
1989-90	30	360	390

Note: Monitoring results are tabulated from July 1 through June 30 of each year. Also, any results not reported in time to be tabulated will be added to the next years report. Therefore, results are not a tabulation of monitoring activities in any given year for the county. All positive detections to date have been 1,2-D and aldicarb or its breakdown products (Brown et al., 1986; Ames et al., 1987; Cardozo et al., 1988; Cardozo et al., 1989; Miller et al., 1990).

Two pesticides, aldicarb (Temik®) and 1,2-D, have been detected in ground water in Del Norte County. As a result these pesticides are no longer available for use by lily bulb growers. The loss of these chemicals resulted in the increased use of replacements, such as 1,3-D, fenamiphos (Nemacur®), methyl bromide, metam-sodium, and phorate.

In 1987, DFA issued a "Notice of Fenamiphos Find in California Soil and Registrants' Opportunity to Request Hearing" based on the detection of fenamiphos residues below eight feet in soil near Smith River, CA, and the determination that such residues were the result of agricultural use in accordance with state laws and regulations. The registrant requested a hearing and a hearing notice was issued. However, the hearing notice was rescinded by DFA because DFA had not determined that the soil residues of fenamiphos were below the depth of the soil microbial zone and the root zone, as required by law.

The depth of the soil microbial zone and the root zone could not be determined because these zones are not sufficiently defined in the law (FAC, 13149). Regulations proposed by DFA to clarify the meaning of these two zones were rejected by the Office of Administrative Law. Therefore, only chemicals actually found in ground water subject of hearing under PCPA.

The detection of fenamiphos below eight feet in soil prompted the registrant to voluntarily withdraw use on bulbs including Easter lilies. The subsequent loss of 1,3-D left the growers with only a few choices for nematode control, namely fumigation with metam-sodium or methyl bromide and in-row treatment with phorate. Because of lack of confidence with fumigants and generally higher costs and known phytotoxicity with phorate, growers felt their nematode control options to be very limited and expressed their concern to DFA (Crockett, 1990). The growers perceived the loss of fenamiphos to be due to monitoring results that reflected sample contamination rather than actual leaching of fenamiphos (Crockett, 1990). This concern, in part, stems from Weaver et al. (1988), who stated that the apparent deep movement of the parent compound into the soil suggests that contamination may have occurred during the soil coring process, and this problem should be investigated in the future. In a follow-up study with improved sampling procedures, fenamiphos was again detected at depths greater than 8 ft. in the soil, indicating the potential for fenamiphos to leach to ground water (Oshima, 1990; report in progress). Even though fenamiphos has not been found in ground water, it is unlikely that the registrant will pursue reregistration for use on lily bulb fields in the North Coast.

A study of phorate (Thimet® or Rampart®) and ethoprop (Mocap®) (Weaver et al., 1988) showed that leaching of phorate was less severe in a loamy soil in Del Norte County even though nearly 50 inches of rain fell on the study plot. However, ethoprop may pose a threat to shallow ground water due to leaching under conditions of high rainfall in Del Norte and Humboldt Counties. Weaver et al. (1990) also recommended that where either phorate or ethoprop are used extensively that studies should be conducted to reduce the potential for leaching, and that the studies should include soil and well monitoring.

Growers requested the North Coast Regional Water Quality Control Board to evaluate the leaching and ground water contamination potential of ethoprop on the Smith River Plains using a computer model, because it was not possible to obtain a research authorization (RA) (Appendix F-6). It was felt that the model was useful in predicting the relative risk of using one chemical versus the standard chemical, aldicarb, in the Smith River Plains. However, the model was able to make a prediction of risk only, and not to quantify movement or persistence. The board staff judged that a single, one-time only application of ethoprop, if restricted to certain areas, would probably not pose a threat of ground water contamination (Warner and Gergus, 1990).

Toxic Air Contaminants Law

The DFA program on TACs had an direct, significant impact of lily bulb culture. During monitoring conducted to implement TAC laws, 1,3-D was detected in ambient air at levels of public health concern in Merced County, California (Wells, 1990). As a result, DFA suspended all permits for use of 1,3-D statewide (DFA, Enforcement Letter 90-63). This suspension took away bulb growers primary preplant fumigant and left them with two choices, methyl bromide, which is significantly more expensive than 1,3-D, and metam-sodium, which has been ineffective in previous tests; but which may provide improved control as newer application procedures are tested. Both chemicals require special application equipment. Growers expressed concern over the relatively high acute toxicity to humans of methyl bromide (in spite of high statewide use) and their inexperience with metam-sodium.

Pesticide Registration

Both federal and state laws govern pesticide registration. A product is first registered by the Environmental Protection Agency (EPA). Subsequently, it may be submitted to DFA for California registration. After all of the data required for registration is reviewed and approved and a product is registered in the State, that label becomes the law and must be followed. Any changes to the label must go through a review and approval process by EPA and DFA. Amendments to the label occur under EPA Federal Insecticide Fungicide Rodenticide Act (FIFRA) regulations as 1) a routine full registration, 2) an emergency use, or 3) as a special local need (SLN). If an emergency use or SLN is desired by growers (or others), the support of the pesticide manufacturer is needed before any changes in labeling occur.

Any person wishing to conduct research on any pesticide which is not registered for the intended purpose must obtain a RA from DFA, except for research conducted by chemical companies (on their own property), universities and colleges. However, institutions must operate according to official policy which covers pesticide use and experimentation (CCR, section 6261). The UC's policy discusses research on non-university controlled land. However, the policy does not discuss research that may contaminate ground water, except to say that the supervisor shall consider the potential consequences of any use of pesticides that may enter bodies or sources of water and that applications will be made in such a manner as to minimize adverse environmental impacts (Univ. of Calif., 1986). Under current circumstances relative to environmental contamination and ground water laws, the UC may be reluctant to research options that include evaluating whether or not a pesticide may leach. There has been concern expressed about potential UC liability of ground water contamination and cost of clean-up.

Pesticide Use

Permits and Reporting

Growers must obtain permits from the CAC to use methyl bromide, carbofuran and 1,3-D. The grower or pest control advisor initially must consider and, if feasible, adopt any reasonable, effective and practical mitigation measure or use any feasible alternative which would substantially lessen any significant adverse impact on the environment (CCR, section 6426). Before issuing the permit, the CAC reviews human safety and environmental conditions and satisfies himself or herself that the application can be made safely (CCR, sections 6420 - 6444).

Beginning January 1, 1990, growers were required to report applications of all pesticides to the CAC and DFA. Through August, 1990, pesticide use on each lily bulb field was reported to the Del Norte CAC, but beginning in September 1990, pesticide use was on a section basis (approximately one sq. mile). This change consolidated information from several fields, thereby losing information about pesticide use on each field.

The CAC may adopt regulations which supplement DFA regulations governing the conduct of pest control operations. Regulations must be approved by the Director before the CAC can start implementation (FAC, section 11503). Additionally, except as provided in law, no ordinance or regulation of local government may prohibit or regulate use of economic poisons (FAC, section 11501.1). If the growers propose certain pest control procedures that should be followed by all growers, then regulations may be necessary and certain laws established to allow for this provision. (See Pest Control Districts and Marketing Orders, page 21.)

Worker and Public Safety

Exposure to chemicals by workers is limited to bulb dip operations, planting and flower removal. For a typical field, the bulb dipping can be accomplished by one person and planting by four persons; the seasonal duration is about four weeks. Flower removal begins in late spring and can be accomplished by one or two persons until near harvest. Any changes in practices or chemicals, such as use of drip irrigation and chemigation, use of different chemicals in bulb dips or foliar treatment should be evaluated for risk by CAC and growers. If chemicals used in dips are hazardous, workers, who plant bulbs by hand, must be protected from residues on the bulb. Using gloves may help, but proper safety precautions must be taken since workers will be using their hands for other purposes, particularly rubbing exposed areas, eating or smoking.

Acutely toxic fumigants are the pesticides of choice for preplant treatments, therefore extreme care in use must be taken because of proximity of fields to dwellings. Because of the potential for contaminating drinking water wells, risk of contamination from new

pesticides or new uses should be evaluated before implementation (Water Quality Control Board, 1985). By working with growers, registrants, SWRCB, CAC, and DFA the risk of contamination may be reduced.

The DFA regulates pesticides that have been declared TACs. Growers use three chemicals, 1,3-D, methyl bromide and acephate (Orthene®), which are being considered as candidate TACs (Oudiz et al., 1989). Any changes in the use patterns of these, or similar, pesticides may alter the risk to humans and potential risks should be evaluated before major changes in pesticide use occur.

Environmental Safety

Growers implementing practices stemming from research involving pesticides or cultural practices must take into account the potential for water contamination (ground and surface water), air pollution, soil contamination and erosion, and resistance of pests to pesticides (Water Quality Control Board, 1985).

Pesticides with the least potential to leach to ground water are characterized by low mobility (i.e. low water solubility, high soil adsorption coefficient) and low persistence (i.e. short half lives for hydrolysis, aerobic and anaerobic soil metabolism, and dissipation). Such pesticides would enter plant roots and would be applied more frequently at low rates rather than a single high rate (Wilkerson and Kim, 1986 and Johnson, 1988 and 1989).

Consideration must be given to disposal of chemicals used in the dip process. Dipping is preferred because a lower amount of material is needed. Additionally, methods for monitoring levels of active ingredients in the dip need to be developed.

Nursery Certification

Easter lily bulb production is classified as a nursery operation. There are several laws and regulations that affect the operation of nurseries relating to pests. Any nursery that ships plants to another nursery must have the plants inspected and certified to be commercially clean, that is, to have no significant pest problem. The inspection process, which is usually conducted by representatives of the CAC, may involve taking plant and soil samples for analysis for nematodes (Appendix F-4 and H). Thus, nematodes must be controlled not only to improve yield but to satisfy mandates in the law.

If the treatment and handling procedures approved by the DFA are followed by the nursery and certified by the CAC, then a sampling program is not necessary (Appendix G). The only DFA accepted treatment procedures for nematodes are methyl bromide alone or methyl bromide followed by oxamyl.

Standards of Cleanliness

Nurseries must also comply with nursery laws and regulations that deal with standards of cleanliness. The standard for nematodes on bulbs is either none detected as measured by specified laboratory extraction methods or fumigation of the field to be certified (CCR Section 3060; Appendix G).

In the case of ornamental plants, the inspection is usually visual. Lesion nematode symptoms (discolored lesions on the roots) are common and a few nematodes are always present and easily detected. The growers are concerned that they are in constant jeopardy and must do whatever is necessary to prevent the nematode problem from being a significant marketing issue.

Certification of Nursery Plants

Several cooperative industry and government programs have been established to certify that various types of plant material are free from pests (Appendix F-1). The purpose of these programs is to certify plants as pest-free after an impartial third party, such as the county agricultural commissioner, completes an inspection. Several regulations have established industry certification programs to provide for clean nursery stock. The establishment of a similar type of program may be useful to the Easter lily bulb industry with the objectives of providing a quality product and reducing nematicide use.

Garlic and strawberry producers have programs established in regulation to provide plant material that is free from nematodes and plant viruses. Regulations on the garlic and strawberry industries serve as typical examples of a certified clean nursery stock program. The regulations cover grower responsibilities, cultural practices that are to be followed, government inspection and testing procedures, approval and certification procedures, revocation of certification, and fees from growers to support the program. Aside from regulatory procedures, it is also necessary to maintain a foundation planting which is free from significant pests. To achieve this, two conditions are necessary: 1) propagating pest-free stock, and 2) maintaining land free from the pests of concern. To establish land that is free from lesion nematode, it would be necessary to have an intensive program involving soil fumigation, weed control, and inspection and quarantine of potentially contaminated plant material and equipment. If a similar program were successful for Easter lily bulb growers, certain uses of nematicides, such as in-furrow treatment, would be reduced or eliminated because infested bulbs were not being planted.

Pest Control Districts and Marketing Orders

It may be desirable to regulate certain IPM practices, such as requiring a pesticide rotation schedule to reduce the amount of

specific pesticides applied in the Smith River region in any given year (Crockett, 1990). Any rotation scheme is dependent on the number of options available; that is, as the pest control options increase, the rotation time can be lengthened. To accomplish this it may be necessary to establish an organization, such as a pest control district, to manage enforcement guidelines. Two pest control districts, which may serve as models, have been established in law to regulate pests and pesticide problems: the Citrus Pest District Control Law (FAC, section 8401 through 8759) and the Cotton Pests Abatement Districts (FAC, section 6051 through 6085).

The Citrus Pest District Control Law was originally passed in 1939 for the control and eradication of red scale. It has since been amended to include administration of programs for the more effective control and eradication of any citrus pests (Appendix F-2).

The Cotton Pests Abatement Districts were formed to control pests on a regional, rather than a field by field, basis and restrictions were placed on seasonal use of certain pesticides to minimize disruption of an IPM program (Appendix F-3).

Procedures for marketing orders, established in law and known as "The California Marketing Act of 1937", provide for the orderly marketing of commodities (Appendix F-5). Additionally, marketing orders provide for uniform grading and proper preparation of commodities for market. If a marketing order is established, an advisory board is created for administrative purposes. A marketing order may contain provisions for carrying out research in production, processing, or distribution. A trust account may be established for research (FAC, section 58892). All producers of a commodity in the marketing order participate. A marketing order for a specific commodity is detailed in regulation and must provide for such activities as management, elections, and penalties for those who do not pay promptly. The Easter lily bulb growers have established a similar program, except that it focuses on research and is voluntary.

Either a marketing order or a pest management district may be useful in expanding Easter lily bulb markets and research, and in regulating pesticide use. The following table summarizes the two basic organizational alternatives, marketing orders and pest control districts.

Table 3. Comparison of Marketing Orders and Pest Control Districts.

Item	Marketing Orders	Pest Control Districts
Target area	Specified in order	Specified county or counties
Procedure to establish	1. Petition director 2. Producer approval 3. Director approval	1. Legislative sponsor 2. Legislation to create district 3. Petition county supervisors 4. Producer approval 5. County supervisor approval
Estimated time to establish	Minimum four months	One year
Limitations	Not pest oriented	Deals with pests and pesticides

Memoranda of Understanding

There are several memoranda of understanding (MOU) between the SWRCB and other government agencies that deal with pesticides and water quality.

The SWRCB and USDA, Soil Conservation Service (SCS) have agreed to share information, accelerate implementation of best management practices (BMPs) and other non-point source (NPS) control measures, and increase overall program effectiveness. The SWRCB and SCS recognize the need to improve, conserve, and protect the quality of surface and ground water by undertaking efforts to avoid harmful NPS contamination and, thereby maintain the quality and quantity of water available for safe drinking supplies, irrigated agriculture, fisheries, and other beneficial uses (Appendix I).

The SWRCB and DFA agree to share information, promote the identification and development of BMPs to protect beneficial uses of water, and implement BMPs first on a voluntary basis followed by mandatory compliance (Appendix J).

Policies

Agricultural policies that relate to options to implement IPM are either written enforcement letters, issued by the Pesticide Use

Enforcement Branch of DFA, or CAC policies and guidelines. The following policies and guidelines, which have been developed by the County Agricultural Commissioner's Association, have some bearing on the options presented and should be reviewed when evaluating options:

The County Agricultural Commissioner in California. This is a general policy that lists objectives for the CAC that includes the encouragement and promotion of pest management and environmental protection by enforcement of laws and regulations.

Pesticide Policy. This CAC resolution outlines their position on pesticide use and safety. The CAC recognized the need for pesticides and that pesticide problems can be mitigated by elimination of certain uses and careful regulation of other uses.

Adoption of Local Pest Control Regulations. This is a guideline outlining procedures for the CAC to follow when adopting regulations applicable to the county, such as those that might be necessary for a pesticide rotation program (Regional Coordinators Office, 1990).

INTEGRATED PEST MANAGEMENT OPTIONS TO CONSIDER

Following discussions with researchers, growers, and regulatory officials a number of options for controlling nematodes in the lily bulb industry have been developed. There is support for an IPM program that reduces the risk of ground water contamination, does not substitute one risk for another, and, where possible, reduces pesticide use. Options are for consideration by DFA, CAC, growers, researchers and others with an interest in reducing risks associated with pesticide use on lily bulbs and fields on the North Coast.

The options presented below are not in any priority and will require thorough analysis before any decision is made to proceed towards implementation. Furthermore, other options will be developed as discussions occur with those working on reducing the risk of ground water contamination. Work on several options can be started in early 1991; however, implementation and success will require many years.

1. Assess the feasibility for a clean stock program. The Easter lily bulb industry could meet with experts representing other commodities, such as garlic and strawberry to explore a clean stock program. Also, expanding research into germinating Easter lily seeds instead of using scales or bulblets to produce yearlings offers promise of reducing nematode problems.

2. Establish a program for rotating use of nematicides. Lily bulb growers suggest that alternating chemicals on a seasonal basis would

be a short term solution to reducing risk of ground water contamination. Currently fields are planted to lily bulbs every three or four years and the same nematicides are used. One example would be to use another nematicide which would, in effect, establish an eight year rotation for any specific chemical. For example, a specific piece of ground that is planted every four years could only be treated with the same chemical every eight years. If a third chemical were available, then the rotation could be every twelve years.

On a regional basis, nematicides could be alternated every year. Care must be taken so as to not substitute one problem for another, particularly when integrating a new chemical into the rotation.

Any IPM program that mandates certain uses of pesticides will require the involvement of the CAC, North Coast Regional Water Quality Control Board, DFA, growers, and others, and would probably involve changes in laws, regulations, or policy. Furthermore, additional research that would integrate pest control, nursery stock certification, protection of workers, and ground water protection considerations is needed.

3. Establish policy that pesticides containing chemicals detected in ground water will not be reviewed under the PCPA if the contamination was the result of use under an RA. This policy would encourage research to understand and reduce ground water contamination without starting the hearing process specified in the PCPA.

4. The lily bulb research committee consider either including or consulting with someone familiar with environmental issues and regulations when establishing research priorities. The bulb growers have established a research committee that includes growers and researchers to assess research priorities. This assessment could be strengthened by inviting representatives of regulatory agencies to help establish research priorities that include environmental issues.

5. Study population monitoring techniques and treatment thresholds to improve aphid control. Any research in this area should include methods to detect the presence of cucumber mosaic virus (Banik and Zitter, 1990).

6. Assess the air contaminant and ground water risk associated with the use of 1,3-D for Del Norte County. A return to the use of 1,3-D would allow growers a proven product which is cost-effective when compared to methyl bromide (special application equipment needed) and metam-sodium (aspects of efficacy uncertain). However, the risks associated with use may be altered as more information is learned about potential for environmental contamination and health and safety to humans. Use of 1,3-D should be in conjunction with research projects that either reduce risk of contamination or hazards to humans and projects that lead to alternative soil pest control practices. Any use of 1,3-D would likely be in June or July so that growers can prepare for bulb planting in August. Decisions to allow use of 1,3-D should take into account season of use.

7. Assess the need for changes in laws or regulations to facilitate the development or implementation of an IPM program which would reduce the risk of ground water contamination. The introduction of any law change will likely take several years to complete; regulations may take less time.

Consider legislation that would authorize the formation of pest management districts for specific regions. Grower administration of an IPM program is important (Tarlock, 1980.) Any new requirements on growers that would have to be enforced by the CAC on all lily bulb growers should be placed into regulation.

8. For pesticides that require a permit, DFA could recommend conditions for pesticide use to commissioner in Del Norte County. Recommendations could include pesticide management schemes, monitoring procedures, BMPs, or other requirements to protect ground water. These recommendations should be developed in cooperation with growers, CAC, DFA, and others as appropriate and may be adopted as a standard (CCR Section 6000.3, 6110 and 6116, Appendix F-6).

9. Develop nematode-resistant lily bulbs. The possibility of incorporating nematode resistance features into the genetic stock of Easter lily bulbs will require research. The most promising development is the discovery of a strain of Bacillus thuringiensis that has nematicidal properties. Mycogen Corp., who has patented the strain, is working with Monsanto Chemical Co. to incorporate nematicidal activity into the roots of plants, the best place to control root-feeding nematodes. It will take roughly 10 years before this technique is available to any growers (Dr. Leo Kim, personal communication).

10. Assess whether the application of nematicides through drip lines sufficiently reduces the risk of leaching. The objective would be to apply only enough water and chemical to control nematodes when they are most susceptible.

11. Increase research funds. Research is important to the development of IPM strategies. Since research funds are scarce, consideration could be given to redirecting funds from savings in lower pesticide costs, and looking to the forced-bulb industry to support cooperative research.

12. Research nematode populations dynamics in lily bulb fields. This would provide information on when chemicals need to be in the soil for maximum effectiveness.

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APPENDICES

1989

ANNUAL CROP AND LIVESTOCK REPORT

DEL NORTE COUNTY
DEPARTMENT OF AGRICULTURE

OFFICES OF

AGRICULTURAL COMMISSIONER
SEALER OF WEIGHTS & MEASURES
ANIMAL CONTROL
UNDERGROUND STORAGE TANKS

Del Norte County
Department of Agriculture
2650 Washington Blvd
Crescent City, CA 95531

GRIFFITH YAMAMOTO

DEL NORTE COUNTY

1989 CROP REPORT SUMMARY

AGRICULTURAL
COMMISSIONER

	<u>1989</u>	<u>1988</u>
Field Crops	\$ 1,212,900	\$ 1,284,700
Vegetables & Fruits*	363,700	418,500
Nursery Crops	8,357,400	8,631,500
Livestock	4,162,600	3,746,900
Livestock Products	<u>2,498,500</u>	<u>2,267,000</u>
Subtotal	16,595,100	17,348,600
Timber Production	<u>44,363,700</u>	<u>33,552,500</u>
Total	60,958,800	50,901,100
Includes Miscellaneous*		

LIVESTOCK INVENTORIES

Item	January 1, 1990	January 1, 1989
All Cattle & Calves	11,800	11,000
Beef Cows	1,100	1,000
Milk Cows	2,600	2,300
Sheep & Lambs	300	300
Hogs	200	200

FIELD CROPS

Item	Year	Harvested Acreage	Per Acre	Total	Unit	Per Unit	Total Value
Hay (Grain)	1989	500	4.0	2,000	ton	110.00	220,000
	1988	700	4.0	2,800	ton	106.00	296,800
Hay (Other)	1989	1,650	3.2	5,445	ton	75.00	408,400
	1988	1,675	3.4	5,695	ton	70.00	398,700
Pasture (Irrigated)	1989	5,350	xxx	xxx	acre	60.00	321,000
	1988	5,400	xxx	xxx	acre	60.00	324,000
Pasture (Other)	1989	21,960	xxx	xxx	acre	12.00	263,500
	1988	22,100	xxx	xxx	acre	12.00	265,200
Total	1989						1,212,900
	1988						1,284,700

VEGETABLE & FRUIT CROPS: PRODUCTION & VALUE

Item	Year	Total
Vegetables & Fruits	1989	21,500
	1988	20,500

APPENDIX B

MEMBERS OF THE EASTER LILY RESEARCH FOUNDATION

Mr. Gary Strahm
Strahm's Lilies
15441 Oceanview Dr.
Brookings, OR 97415
(503)469-3792

Mr. Raymond Yock
Oregon Lily Co.
15696 Hwy. 101 South
Brookings, OR 97415
(503)469-7349

Ms. Susanne Freeman
Winharbor Farms
P.O. Box 2065
Harbor, OR 97415
(503)469-7242

Mr. Robert Hastings
Hastings Bulb Growers, Inc.
P.O. Box 2155
Harbor, OR 97415
(503)469-3759

Mr. Harry Harms
Smith River Farms, Inc.
P.O. Box 2186
Harbor, OR 97415
(503)469-3759

Mr. Lee Riddle
Pacific Bulb Growers Research Sta.
15636 Hwy. 101 So., 96370 Wildwood Road
Brookings, OR 97415
(503)469-2215

Mr. Henry Itzen
Itzen Bulb Farm, Inc.
P.O. Box 1124
Brookings, OR 97415
(503)469-3405

Mr. Robert Stanhurst
& Mr. Gary Derr
P.O. Box 540
Smith River, CA 95567
(503)469-2062

Mr. Robert Miller
Dahlstrom & Watt Bulb Farm, Inc.
P.O. Box 106
Smith River, CA 95567
(707)487-3961

Mr. John Westbrook
Palmer Westbrook, Inc.
P.O. Box 266
Smith River, CA 95567
(707)486-3843

Mr. Don Crockett
United Lily Growers
P.O. Box 220
Smith River, CA 95567
(707)487-6421

APPENDIX C

Pesticide Use Reported for Bulbs in Del Norte County for 1988 (DFA, 1990)

The fumigation of soil in July is presented as the beginning of the bulb growing season

	pounds, a.i.	acres
July		
1,3-D	65118	185.0
carbofuran	376	175.4
August		
1,3-D	57054	178.0
carbofuran	30	28
phorate	802	122
September		
carbofuran	16	10
phorate	257	38
October		
phorate	300	33.5
November through February	no treatment on bulbs reported	
March		
oxamyl	68	72
April		
methomyl	2.7	6
oxamyl	42	42
May		
carbofuran	320	242.8
June		
carbofuran	123	114.5
oxamyl	121	121

a.i. = active ingredient

APPENDIX D

TO: Mr. Adolf Braun
Department of Food and Agriculture
Environmental Monitoring, Rm. A-149
1220 N Street
Sacramento, CA 95814
U.S.A.

Subject:
Nematode Control in Lilies

Date
19 October 1990

Dear Mr. Braun:

As promised, I am sending you copies of research articles and extension publications regarding chemical control of nematodes.

You also requested me to contact other scientists who are specialized in this area. I believe, however, that it would be more appropriate for you to personally contact these scientists. You will then be able to discuss your specific concerns with them. It will help these scientists in finding and providing you with relevant publications.

You may contact the following scientists and research stations:

1. Mr. C.G. M. Conijn
Research Laboratory for Bulbs
P.O. Box 85
2160 AB Lisse
Phone: 02521-19104
2. Mr. Ir. P. Maas
Plant Pathology Research Institute
Binnenhaven 12
6709 PD Wageningen
Phone: 08370-19151
3. Staring Center
Marijkeweg 22
6709 PG Wageningen
Phone: 08370-74342
4. Plant Protection Service
Geertjesweg 15
6706 EA Wageningen
Phone: 08370-96911

I hope this information will be useful to you.

Sincerely,

Signed: E. Rijnders

(TRANSLATED FROM DUTCH BY ADOLF BRAUN, CDFA)

Table 1. The effects of aldicarb and oxamyl (amounts/ha) kg: soil treatment; 1; foliar treatments; %: Bulb treatment (dipping) on number of nematodes (*P. penetrans*); crop performance, yield and root quality after a 2 year cultivation of the variety "F. King".
Yield: Treatment 5 = 100 = 6.0 kg/plot
Crop performance: 1 = poor, 10 = best.
Root quality: 1 = poor, 10 = best.

Nematicide treatments		1978	1979			
		Number nematode /10 g of roots	Crop stand on 5/2	Number nematode /10g of roots	Yield	Root quality
1978	1979					
no treatment	no treatment	1297	5.3	5879	90	5.7
15 kg ald. on 4/4	no treatment	488	5.7	2740	89	5.0
15 kg ald. on 4/4	15 kg ald. on 14/4	653	5.7	3997	94	7.3
30 kg ald. on 4/4	no treatment	342	7.0	1868	95	6.7
30 kg ald. on 4/4	15 kg ald. on 14/4	170	8.3	3132	100	7.7
15 kg ald. on 4/4 + 6 1 ox. on 6/16	no treatment	802	6.3*	3232	106*	6.7*
15 kg ald. on 4/4 + 6 1 ox. on 7/24	no treatment	1032	5.3	4870	91	5.0
15 kg ald. on 4/4 + 6 1 ox. on 8/23	no treatment	180	7.3	3488	95	5.7
15 kg ald. on 4/4 + 6 1 ox. on 6/16	6 1 ox. on 6/16	640	5.7	3380	90	5.7
15 kg ald. on 4/4 + 6 1 ox. on 7/24	6 1 ox. on 7/24	943	6.3	3217	81	5.0
15 kg ald. on 4/4 + 6 1 ox. on 8/23	6 1 ox. on 8/20	197	7.0	3880	94	7.7
30 kg ox. on 4/4	no treatment	1303	5.7	2745	97	5.7
30 kg ox. on 4/4	15 kg ox. on 14/4	1595	5.3	3302	88	6.7
0.5% oxamyl	no treatment	132	8.3	1915	105	9.0
1 % oxamyl	no treatment	20	7.7	807	104	8.7
2 % oxamyl		117	8.3	1862	100	8.7

* unexpected and inexplicably high.

Aldicarb was soil applied. The best results were obtained after a treatment of 30 kg in the first year followed by a treatment of 15kg in the second year. In addition, a treatment in the first two years was better than a treatment in the first year alone.



Aan: De heer A.E.O.L.F. Braun
 Department of food and agriculture
 enviremental monitoring
 Room E 149
 1220 N-street
 Sacramento CA 95814
 U.S.A.

uw brief van	uw kenmerk	ons kenmerk	datum
		ER/AR-174	19 oktober 1990
onderwerp		doorkiesnummer	bijlagen
Aaltjesbestrijding in lelies			div.

Geachte heer Braun,

Volgens afspraak stuur ik u hierbij copieën van onderzoek en voorlichtingsartikelen over aaltjesbestrijding met chemische middelen, voor zover in ons bezit.

Hoewel u mij gevraagd heeft ook literatuur te verzamelen bij anderen, lijkt het mij bij nader inzien verstandiger wanneer u zelf contact opneemt met de onderzoekers die ik genoemd heb. U kunt uw vraagstelling dan duidelijk formuleren waardoor meer gericht naar de literatuur die u zoekt gezocht kan worden.

Adressen hiervoor zijn:

1. Laboratorium voor Bloembollenonderzoek
 Postbus 85, 2160 AB Lisse (tel. 02521 - 19104)
 de heer C.C.M. Conijn
 2. Instituut voor Plantenziektenkundig Onderzoek
 Binnenhaven 12, 6709 PD Wageningen (tel. 08370 - 19151)
 de heer Ir. P. Maas
 3. Staringcentrum
 Marijkeweg 22, 6709 PG Wageningen (tel. 08370 - 74342)
 4. Plantenziektenkundige Dienst
 Geertjesweg 15, 6706 EA Wageningen (tel. 08370 - 96911).
- Ik hoop u hiermee van dienst te zijn geweest.

Hoogachtend,
 Senior bedrijfsdeskundige DLV-Bloembollen,

E. Rijnders

(E. Rijnders)

Dienst Landbouwvoorlichting
 Team Bloembollen en
 Bolbloemen Hoorn

Keern 33
 1624 NB Hoorn
 Telefoon: 02290 - 4 80 44
 Fax: 02290 - 4 88 44

Tabel 1. De werking van aldicarb en oxamyl (in hoeveelheden per ha) kg : grond-
 beh.; 1 : gewasbesp.; % : boldompeling op aantallen aaltjes
 (p. penetrans); gewasstand en opbrengst en wortelkwaliteit bij een
 2-jarige teelt van 'F. King'.
 Opbrengst : beh. 5 = 100 = 6,0 kg per veldje
 Standcijfers : 1 = slecht 10 = best
 Wortelkwaliteit : 1 = slecht 10 = best

Behandeling met nematiciden		1978	1979			
		Aaltjes per 10g bol- wortels	Stand op 2/5	Aaltjes per 10g bol- wortels	Opbrengst	Wortel- kwaliteit
1978	1979					
niets	niets	1297	5,3	5870	90	5,7
15 kg ald. op 4/4	niets	488	5,7	2740	89	5,0
15 kg ald. op 4/4	15 kg ald. op 14/4	653	5,7	3997	94	7,3
30 kg ald. op 4/4	niets	342	7,0	1868	95	6,7
30 kg ald. op 4/4	15 kg ald. op 14/4	170	8,3	3132	100	7,7
15 kg ald. op 4/4 + 6 l ox. op 16/6	niets	802	6,3*	3232	106*	6,7*
15 kg ald. op 4/4 + 6 l ox. op 24/7	niets	1032	5,3	4870	91	5,0
15 kg ald. op 4/4 + 6 l ox. op 23/8	niets	180	7,3	3488	95	5,7
15 kg ald. op 4/4 + 6 l ox. op 16/6	6 l ox. op 16/6	640	5,7	3380	90	5,7
15 kg ald. op 4/4 + 6 l ox. op 24/7	6 l ox. op 24/7	943	6,3	3217	81	5,0
15 kg ald. op 4/4 + 6 l ox. op 23/8	6 l ox. op 20/8	197	7,0	3880	94	7,7
30 kg ox. op 4/4	niets	1303	5,7	2745	97	5,7
30 kg ox. op 4/4	15 kg ox. op 14/4	1595	5,3	3302	88	6,7
0,5% oxamyl	niets	132	8,3	1915	105	9,0
1 % oxamyl	niets	20	7,7	807	104	8,7
2 % oxamyl		117	8,3	1862	100	8,7

* onverwacht en onverklaarbaar hoog.

Aldicarb

Aldicarb is toegepast als grondbehandeling. De beste resultaten worden gevonden na een toepassing van 30 kg in het eerste jaar en 15 kg in het tweede jaar. Bovendien is een behandeling in het eerste en het tweede jaar beter dan een behandeling alleen in het eerste jaar.

*John Rector's Handout for the July 6, 1989 meeting of the
USDA Food and Agriculture Council's Nonpoint Source Committee
Davis California*

DEFINING THE BMP FOR APPLICATION USING PRACTICAL CONCEPTS

The following definition of BEST MANAGEMENT PRACTICES (BMP) is extracted from the August 19, 1987 National EPA guidance on non point source controls and water quality standards signed by Lawrence J. Jensen, EPA's Assistant Administrator for Water. **

"Best Management Practices (BMPs) are methods, measures or practices to prevent or reduce water pollution, including but not limited to, structural and non-structural controls, operation and maintenance procedures, other requirements and scheduling and distribution of activities. Usually BMPs are applied as a system of practices rather than a single practice. BMPs are selected on the basis of site-specific conditions that reflect natural background conditions and political, social, economic, and technical feasibility."

From the above, it becomes obvious that what constitutes a BMP is constrained only by personal or organizational limitations, and acceptance by a State as a BMP. Ultimately, practices assume "best" management practice credibility after certification or approval by the State agency legislatively responsible for non point source pollution control.

They can be:

- + Curative or Preventative - Improving already deteriorated water or stopping new pollution
- + Methods, Measures or Practices which are;
 - Structures - Dams and ditches etc.
 - Non Structures - re-vegetation etc.
 - Operations - planning & design of activities
 - Maintenance - assured operational intent of structures, facilities, etc.
 - Schedules- season or chronology of activity initiation
 - Distribution- Activity location relative to water or to other activities.

They are:

- + Site Specific regarding
 - Natural background conditions
 - Political Feasibility
 - Social Feasibility
 - Economic Feasibility
 - Technical Feasibility

** See also the parent definition of BMP in 40 CFR 130.2 (1) from which this simplified EPA guidance definition is drawn.

It is stated that a BMP is "applied", and application means an action is taken. Hence, prevention or reduction of water pollution results from an ACTION being taken. A generalization of the August 19 EPA guidance definition then might be;

A BMP IS A SITE SPECIFIC ACTION TAKEN TO PREVENT OR
REDUCE WATER POLLUTION FROM NON POINT SOURCES.

For understanding, it is useful to consider these water pollution control actions as either administrative or physical in nature. Physical actions are perhaps the most readily recognized. They are characteristically manually applied measures that are readily visible on the ground. Examples of these actions might be;

- + constructing water bars across roads or skid trails
- + spreading grass seed on exposed soil
- + placing jute matting on cut or fill slopes.
- + signing streamside management zones (buffer strips)
- + installing drop structures or gully plugs.

Administrative actions are perhaps the most overlooked methods of controlling non point pollution as they are not readily visible. They are characteristically time, space and procedural oriented measures that are implemented as personal or organizational controls. Examples of these actions might be;

- + schedule the implementation of activity to avoid the Winter/Spring wet season.
- + delineate all skid trail and log landing locations on the timber sale area map prior to putting the contract out for bids.
- + incorporate all water quality protection measures into the contract provisions.
- + require roads be located on ridge lines rather than valley bottoms during project design and layout.
- + plan activities to assure spatial dispersion.
- + review project implementation documents to insure protection methods and measures are incorporated.
- + inspect project sites to insure protection measures are in place.

APPLICATION OF THE BMP

The key to non point water quality protection is assuring that the right methods, measures or practices are in place to assure the action prevents or reduces pollution. Two options are available to the land manager/owner in identifying the correct action to take; Option 1 - Process BMPs where inventory and analysis result in custom fit practices, measures and methods, and Option 2 - Standard BMPs where a selection is made from a list of "canned" or "fixed" methods, measures or practices. The option used is basically a function of the expertise (personnel) available to visit a project site, assess the area's physical and biological environmental attributes, evaluate these attributes within the political, economic and social feasibility frame work, and identify specific actions to be taken. Looking at each option closer and reviewing some example BMPs will help identify which option a land owner/manager should pursue.

Process BMPs

This option is most amenable to land owners/managers similar to the Forest Service where multiple resource specialists are available. Resource specialists (e.g. soil scientist, hydrologist, geologist) visit the proposed project area to conduct an on-site assessment of the potentials for impacts to water quality. Field data needed to analyze impacts and identify mitigation measures is collected. Office analysis, involving interaction with other specialists (e.g. design engineers, economists, contracting officers) results in the identification of actions needed to protect water quality and/or reduce pollution. An example of a process BMP is as follows;

BMP TITLE: Road Cut and Fill Slope Stabilization
OBJECTIVE: To prevent accelerated erosion from occurring on exposed cut and fill slopes.

EXPLANATION: Depending on various factors such as slope angle, soil type, climatic patterns, surface vegetative conditions and proximity to surface water; exposed road slopes and spoil disposal areas will require measures to provide for surface soil stability. The level of stability required and methods and techniques of accomplishment must be determined on a case-by-case basis. Construction sites will be evaluated by soil scientists and hydrologists prior to commencing construction. Cut and fill portions of the road that have the potential to impact water quality will be identified, and data collected that will allow analysis of the impact and development of protective measures.

IMPLEMENTATION: Vegetative stabilization is generally supplementary to mechanical measures of soil stabilization employed during construction. Site specific water quality protection measures, methods and practices are identified in the specialists reports following field and office analysis. These requirements are incorporated into construction contract specifications. Landowner/manager personnel monitor the implementation of the water quality measures during construction and monitor effectiveness after construction.

This is considered a Process BMP as it does not document specific action(s) to be taken to accomplish slope stabilization (e.g. seeding, hydro-mulching, terracing, etc.). Instead, this type of BMP establishes a procedure to be followed which will result in the formulation of tailor made methods and techniques for non point pollution control.

Given this is a typical Process type BMP, the question might well be asked how it is applied on a project basis. To illustrate, consider a hypothetical Forest Service project of constructing four miles of road.

Following the indicated BMP procedure;

- 1) The ID Team members visit the project site and assemble the following information/data.

* the proposed road center line is flagged following the land contour.

- * the road is 100 yards up slope from a stream.
- * the hill slope is 15 percent
- * soils are volcanic (Cohasset) very deep, well drained and highly erosive when vegetative cover is removed.
- * 85% ground cover currently on site of sage and fescue grass
- * land stability problems (slumps, slides) are not evident

2) Office investigation indicates low total precipitation averaging 10 to 14 inches with a mean temperature of 58 degrees.

Given the above circumstances the soil scientist and hydrologist working independently identify four alternative actions that can be taken to control the road slope erosion. All of the following four actions have proven to be equally effective at controlling road slope erosion elsewhere in the watershed.

a - Broadcast seed the exposed slopes with Rye grass and cover with jute matting.

b - Compact fill slopes in 6 inch lifts with sheepsfoot roller and hydro-mulch exposed surfaces.

c - Broadcast seed with Rye and windrow brush at base of fill slope toe to trap eroded soil.

d - contour furrow cut and fill slopes to enhance infiltration and preclude slope surface runoff.

3) Interaction with the Forest economist and design engineer indicated that hydro-mulching and contour furrowing are not cost effective for this road. The Forest ecologist indicated that the Native Plant Society would object to the introduction of Rye grass seed to this area as it is a non-native species. The Wildlife biologist on the Forest expressed concern over the use of jute matting in the proximity of a deer calving area. Through interdisciplinary interaction the team agrees on alternative "c" as the action to take to protect water quality modifying it to call for Fescue grass seed in place of the Rye.

4) Contract stipulations are written that require the contractor to broadcast seed the slopes with Fescue.

5) The stipulations are incorporated into the contract, and it is put out for bids.

6) The Forests Contracting Officer Representative inspects the application of seed during the actual construction.

7) Effectiveness of the stabilization actions are evaluated by the Hydrologist/Soil Scientist and documented.

Standard BMPs

This option is amenable to those managers/landowners that do not have a cadre of professional scientists to conduct field investigations and analysis such as the small landowner. A standard set of practices are developed (most frequently by authorized state agencies) from which the landowner/manager selects the ones applicable to the given non point pollution generating

activity. Typical examples of Standard BMPs are sets of state Forest Practices Rules and regulations. These commonly consist of a list of preventive methods and measures from which the owner/manager selects the practice(s) to apply. Flexibility of the practice(s) and fitting to site suitability are accomplished by having more than one fixed measure/practice to select from to accomplish protection. To illustrate, consider the same hypothetical road construction example just discussed being applied in the case of a small woodlot owner's situation.

Assume the Standard BMPs for road construction listed in the respective State Division of Forestry's "Forest Practices Rules" are;

ROADS

- * Locate Roads at least 300 feet from streams and standing surface water
- * Roads located between 300 and 200 feet of a stream or standing surface water body will require that a 50 foot equipment exclusion buffer strip be left adjacent to the water.
- * Roads located within 200 feet of surface water will require a 50 foot harvest and equipment exclusion zone be left next to the water and that the running surface be cover with 2 inch minus rock

Though the practices available to the land owner are fixed, there is still a sufficiently broad enough array of practice alternatives available to the individual to:

- 1) allow for site specific fitting to the physical biological conditions.
- 2) meet the individuals economic needs (e.g. no timber below the 300 foot limit anyway may dictate that the first practice is the action taken, as their is no harvest dollar loss).
- 3) meet the individuals technical feasibility (e.g. maybe there is no equipment owned or available that would allow for rocking the road, so the first and third practices are still viable.

APPENDIX F
LAWS AND REGULATIONS

APPENDIX F-1

California Certified Seed Garlic Law

3044.2. General Provisions

- (a) The University of California shall be responsible for the selection of garlic plants for foundation planting, true-ness to variety, identity, and pest cleanliness of the foundation stock.
- (b) Responsibility of Applicants. The applicants shall be responsible for:
 - (1) The selection of the location and the proper main-tenance of any planting being grown under the provisions of this article.
 - (2) Maintaining the identity of all garlic plants, bulbs, and cloves entered in the program.
 - (3) Farming and sanitation practices.
 - (4) Protecting seed garlic in possession from exposure to or damage by environmental conditions, pests or diseases.
 - (5) Notifying the Department one week in advance of:
 - (A) Planting and replanting dates
 - (B) Harvest and the storage location.
 - (C) Movement of stock from storage.
 - (6) Notifying the Department of the date of all pest con-trol treatments in fields for which inspections must be made.
 - (7) Marking on the registered or certified tag the firm name, date variety, and the assigned block number.
- (c) Location of Plantings.
 - (1) Each planting location shall be subject to the ap-proval of the Department and shall be in an area where the stem and bulb nematode is not prevalent and where con-tamination by stem and bulb nematode from drainage, flooding, irrigation or other means is not likely to occur.
 - (2) Isolation. All fields entered for certification shall be at least 500 feet from any other garlic planting not entered in the program which would expose the fields entered for certification to disease infection. This re-quirement may be waived if protective measures are taken to prevent spread of disease into fields entered for cer-tification.
 - (3) An area not previously approved under the terms of this article may be given a tentative approval provided no conditions for refusal or cancellation are determined by inspection and testing for stem and bulb nematode in each of three successive growing seasons.
 - (4) Each planting shall be on land on which no garlic or other stem and bulb nematode host plants have grown for one year prior to planting. Treatment of the land to eliminate soil-borne pests in an approved manner may be required.

(5) Each increase block and certified block shall be a separate planting of garlic. There shall be a minimum of 12 feet separating the blocks and varieties therein to maintain varietal identity.

(d) Maintenance of Plantings. Any planting entered in this program shall be kept in a thrifty growing condition and pest shall be kept under intensive control. Suitable precautions shall be taken in cultivation, irrigation, movement, and use of equipment and in other farming practices to guard against spread of soil-borne pests to plantings entered in this program.

(e) Storage of Bulbs or Cloves. Garlic produced under the provisions of this article shall be kept after harvest in clean containers and in clean storage areas.

(f) Eligibility for Planting.

(1) In an increase block or certified block. To be acceptable for planting in an increase block or certified block a plant shall be foundation stock or registered stock.

3044.3. Inspection and Testing Procedures.

3044.4. Approval and Certification.

3044.5. Refusal or Cancellation of Approval or Certification.

3044.6. Application and Fees.

Article 9. Regulations for California Certified Strawberry Plants.

3049.1 Definitions.

3049.2 General Provisions

Participation in this program is voluntary and may be withdrawn at the option of the applicant.

Registration, certification, approvals and supervision shall be conducted by the Department.

(a) Except as otherwise provided, certification is based solely on visual inspections of sample plants from each planting.

(b) Responsibility of the Applicant. The applicant shall be responsible for:

(1) The selection of the location and the proper maintenance of a planting being grown under the provisions of this article.

(2) Maintaining the identity of all nursery stock entered in the program.

(3) Notifying the Department at least one week in advance of planting and harvesting as to when they will commence and notifying the Department of the location where the plants will be trimmed and stored.

(4) Maintaining the identity of each lot of plants in the participant's possession and placing the required information on each certification tag furnished by the Department.

(c) Location of Plantings.

(1) General. Each planting location shall be in an area which is isolated from plantings for strawberry fruit production to prevent spread of infectious pests or virus diseases. Any land planted shall have been free of strawberry plants for the previous year, except when treated for soil-borne pests in an approved manner under the supervision of the Department. Any planting may be enclosed by an approved insect-proof screenhouse, and when this is done the distance from other plantings or plants as specified in this article to minimize spread of virus diseases shall not be required providing varieties, plant blocks, and plants to be indexed are kept separate in an approved manner to maintain plant identity. Native strawberry plants presenting no evidence of virus infection are excluded from required isolation distances for planting.

(2) Foundation blocks shall be located at least one mile from any other strawberry plants except those in foundation blocks determined to be of equal pest status. Foundation blocks shall be clone planted. Each plant in a foundation block selected for testing by indexing together with its runners shall be kept separate from all other plants in the block by an open space of 12 inches or by an artificial barrier to maintain plant identity.

(3) Increase blocks shall be located at least one mile from any other strawberry plants to prevent spread of virus disease. When danger of possible spread of virus diseases from one block to another does not appear to exist the one mile distance may be waived and increase blocks and certified blocks may be planted adjacent to each other.

(4) Certified blocks shall be located at least one mile from any strawberry plants maintained for the purpose of commercial fruit production and not less than 500 feet from any other strawberry plants not entered in the program to maintain plant identity and prevent spread of virus diseases.

(d) Maintenance of Plantings.

(1) Any planting entered in this program shall be kept in a thrifty growing condition and pest shall be kept under intensive control.

APPENDIX F-2

The Citrus Pest District Control Law. Summary and Specific Laws

8402. It is the purpose of this part to make available a procedure for the organization, operation, government, and dissolution of districts for the more effective control and eradication of citrus pests.

Citrus pest districts may do all of the following:

- a. Sue and be sued in all actions and proceedings in all courts and tribunals of competent jurisdiction.
- b. Adopt a seal and alter it at pleasure.
- c. Take by grant, purchase, gift, devise, lease, or otherwise, and hold, use, enjoy, and lease, or otherwise dispose of, real and personal property of every kind and description within or without the district necessary to the full and convenient exercise of its powers.
- d. Cause taxes to be levied for the purpose of paying any obligation of the district, and to accomplish the purposes of the district.
- e. Make contracts, and employ all persons, firms, and corporations necessary to carry out the purposes and the powers of the district, and at such salary, wage, or other compensation as the board of directors shall determine.
- f. Eradicate, remove, or prevent the spread of any and all citrus pests.
- g. Enter into or upon any land included within the boundaries of the district for the purpose of inspecting and treating citrus trees and other host plants and fruit growing on them.
- h. Perform any and all acts either within or outside the district necessary or proper to fully and completely carry out the purposes for which the district was organized.

APPENDIX F-3

Cotton Pests Abatement Districts. Summary and Specific Laws

6051 through 6085.

Legislation authorizing cotton pests abatement districts was originally passed in 1968 and was amended in 1982 to establish a pest management program to control significant cotton pests in a designated region in a coordinated manner.

Cotton pests abatement districts can be proposed by submitting a petition to the county board of supervisors which then requires the county agricultural commissioner to submit a register of all cotton producers within the proposed district and to prepare a report to the board on whether conditions of disease, insect, or other pests of cotton warrant the organization of a district. After proponents submit a petition signed by a specified majority of producers, the board of supervisors may declare the district formed and appoint a board of directors to administer the affairs of the district.

6062. Any cotton pests abatement district organized pursuant to this chapter may do all of the following:

- (a) Have perpetual succession.
- (b) Sue and be sued for all actions and proceedings in all courts and tribunals of competent jurisdiction.
- (c) Adopt a seal and alter it at pleasure.
- (d) Take by grant, purchase, gift, devise, lease or otherwise, and to hold, use, and enjoy, and to lease, or otherwise dispose of, real and personal property to every kind and description within or without the district necessary to the full and convenient exercise of its powers.
- (e) Prohibit the planting, growing, or maintenance of cotton plants within the boundaries of the district if it determines that such a prohibition is necessary for cotton pest control.
- (f) Charge fees for permits to plant cotton. The fees shall be used for the purpose of paying any obligation of the district and to accomplish the purposes of the district in the manner provided in the code.
- (g) Make contracts, and to employ, except as otherwise provided in the code, all persons, firms, and corporations necessary to carry out the purposes and the powers of the district, at such salary, wage, or other compensation as the board of directors shall determine.
- (h) Eradicate, remove, or prevent the spread of any disease, insect, or other pest injurious to cotton.
- (i) Eradicate, eliminate, remove, or destroy any cotton plants except those cotton plants which are growing under the conditions of a valid permit.
- (j) Enter into or upon any land included in the district for the purpose of inspecting cotton growing thereon.

- (k) Commence and prosecute appropriate actions to have it adjudged that any cotton plant growing within the district infested with disease, insects, or pests injurious to cotton; or any cotton plant growing within the district without a valid permit; is a public nuisance and have it decreed that the nuisance be abated.

6068. The powers conferred upon any cotton pests abatement district and its board of directors by the provisions of this chapter shall not be construed to be in lieu of other disease, pest, or insect control statutes, but in addition thereto, and no act of any district or of any of its directors, agents, or employees shall operate to deprive or hinder the duly appointed or designated state, county, or federal authorities in conducting any operation for the eradication or control or prevention of any disease, insect, or pest in the district.

APPENDIX F-4

Inspection of Nurseries

3060. Nursery and Seed Inspection.
Definitions. The following definitions, in addition to those stated in Subarticle 10 sections 25-49 and 5001-5008 of the Food and Agriculture Code, apply to this article.
- (a) "Quality nursery and seed inspector" means a representative of the County Agricultural Commissioner who:
 - (1) Possesses a State certificate of qualification in Nursery and Seed Regulation and Plant Quarantine and Pest Detection, or
 - (2) A member of o Commissioner's staff possessing required experience and education, studying of State certification, and working under the supervision of a qualified nursery and seed inspector.
- 3060.1 Inspection of Nurseries.
- (a) Each Commissioner shall inspect nursery stock, other than seed which is being grown or sold as often as is required to assure compliance with pest cleanliness, quality, and varietal trueness standards.
 - (b) Fruit and nut tree, grapevine, berry, vegetable plant and other nursery stock for on-the-farm commercial planting shall be inspected for the detection of nematodes by using laboratory methods approved by the Department. The required sampling may be waived when, in accordance with the treatment and handling procedures approved by the Department, such stock is grown in soil treated to assure against nematode pest infestation.
- 3060.2 Standard of Cleanliness.
- Any person selling, handling or growing nursery stock, other than seed, produced, held, or offered for sale, shall maintain the following standard of cleanliness of nursery stock in his possession.
- (a) All nursery stock shall be kept commercially clean in respect to established pests of general distribution. Commercially clean shall mean that pests are under effective control, are present only to a light degree, and that only a few of the plants in any lot or block of nursery stock or on the premises show any infestation or infection, and of these none show more than a few individuals of any insect, animal or weed pests or more than a few individual infestations of any plant disease.
 - (b) All nursery stock shall be kept free of:

(1) Pests of limited distribution including pests of major economic importance which are widely, but not generally distributed, except as provided in section 3060.4 (a)(1)(C) below; and

(2) Pests not known to be established in the State. Included in the meaning of this paragraph is that turf shall be kept free of noxious weeds.

(c) In addition, fruit and nut trees, grapevine, berry and vegetable plant nursery stock, shall also meet the following conditions to assure that such nursery stock is commercially clean with respect to nematode or other serious soil-borne pests:

(1) No nematode or serious soil-borne pests are found either by visual inspection at time of digging or by laboratory methods, or

(2) If such inspections reveal pest infestations, the Commissioner or the Director may attempt to delimit the infestation. All nursery stock within any delimited infested area shall be held until all nursery stock within the delimited area is treated or otherwise disposed of in the manner and within the time limit specified by the Commissioner or the Director to control or eradicate the pest infestation.

In the event that intensive resampling to delimit the original infestation no longer reveals a nematode pest infestation, the stock shall be deemed to be in compliance with the nematode standards of cleanliness, unless chemical treatments have been made which would interfere with nematode detection. When such chemical treatments have been made, all of the stock in the original area sampled shall be held and treated or disposed as provided in this section.

3060.4 Enforcement.

(a) The Commissioner shall keep records of inspection made and of orders issued to enforce this article.

(1) Inspections of the growing grounds, storage yards, and sales places of nursery stock, other than seed, shall be performed by a qualified nursery and seed inspector who shall make a sufficient examination of all varieties and all lots or blocks of nursery stock and all established plants, appliances, and other things thereon as may be necessary to determine compliance with this article.

(A) The inspection shall be substantiated by the filing with the Commissioner of a report of such inspection showing the names of pests and infested or infected host plants and their location in the nursery, and the disposition of all blocks of stock found infested or infected to a degree greater than the minimum requirements of this article.

(B)- The Commissioner or the Director may require by a written order that any nursery stock found infested or infected with a pest shall be isolated or safely delimited in a manner approved by the Commissioner or the Director, and may specify that the pest shall be controlled or eradicated, or that the infested or infected plants shall be disposed of in a manner satisfactory to the Commissioner or the Director within a reasonable specified length of time.

(C) The Director may permit nursery stock infested with pests, subject to quarantine regulations, to be sold for planting within the area under quarantine where the nursery stock is offered for sale, provided that:

1. a quarantine pest shall not be eligible for movement as described in this section unless it has been so designated by administrative action by the Director, and

2. the nursery stock is moved between points within the area under quarantine and involves no movement outside thereof; and

3. the pest is not under eradication in the quarantine area; and

4. movement of the nursery stock is not specifically prohibited by the quarantine regulation or local ordinance; and

5. the nursery stock is commercially clean.

(D) Nursery stock which does not meet the standards of cleanliness prescribed in Subarticle 10 section 3060.2 shall not be sold except as provided in (C) above or under a written agreement between the buyer and seller which discloses the following:

1. failure to comply with the standards of cleanliness;

2. affirmation of the buyer's agreement to purchase the stock on an "as is" basis; and

3. written agreement by the destination department of agriculture the stock planting by the buyer or resale at retail for non-farm use in the destination county or state.

(b) Notification.

(c) Suspension. The use of nursery stock certificates shall be suspended, as to all nursery stock, other than seed, or as to infested or infected and exposed host plants:

- (1) Upon finding in the nursery any new pest, determined by the Director to be of serious importance to agriculture or pending such determination, until isolation, clean up, or eradication in a manner approved by the Director is complied with; or

- (2) Upon finding in the nursery any pest that is required by this article to be kept under intensive control until either

- (A) All hosts or carriers likely to be infested or infected are prohibited movement by a written hold order or

(B) Adequate precautions or intensive control measures have been applied which will assure the pest cleanliness of hosts or carriers when shipped; or

(3) Upon finding in the nursery an infestation or infection or any established pest of general distribution in a degree greater than commercially clean, until such infestation or infection is controlled to the satisfaction of the Commissioner or Director.

- (d) Revocation. Nursery stock certificates shall be revoked:
 - (1) As to nursery stock, other than seed, upon repeated findings within the preceding twelve months that the shipper has failed to maintain the standard of cleanliness herein prescribed;
 - (2) As to nursery stock, including seed, upon finding the the shipper has violate any law or regulation pertaining to nursery stock, including seed, or the requirements of this article.
- (e) Refusal. Issuance of nursery stock certificates may be refused if during the preceding twelve months:
 - (1) An authorization of the shipper to use nursery stock certificates has been revoked; or
 - (2) The shipper has failed or refused to comply with any law or regulation pertaining to nursery stock or pests; or
 - (3) Conditions in or around the nursery have exposed nursery stock to infestation by pests, including weed seeds, and for which adequate precautions or control measures cannot be or have not been applied.

APPENDIX F-5

Marketing Orders

58601 through 59293. The California Marketing Act of 1937

58615. "Marketing order" means an order which is issued by the director, pursuant to this chapter, which prescribes rules and regulations that govern the processing, distributing, or handling in any manner of any commodity within this state during any specified period.
58744. Any marketing order which is issued by the director pursuant to this chapter may be limited in its application by prescribing the marketing area or portion of the state in which it shall be effective. A marketing order shall not, however, be issued by the director unless it embraces all persons of a like class that are engaged in a specific and distinctive agricultural industry or trade within this state.
58749. The director may issue and make effective a marketing order or marketing agreement which applies to two or more commodities.

Article 8. Advisory Boards and Committees

58841. Any marketing order which is issued pursuant to this chapter shall provide for the establishment of an advisory board to assist the director in the administration of the marketing order. The members of the advisory board shall be appointed by the director and may hold office at the pleasure of the director. A marketing order may, however, provide for the appointment of members from nominations made by producers and handlers and may also provide for the method of selecting such nominees.
58842. If the marketing order affects directly only producers of a particular commodity, the members of the advisory board shall be producers. If the marketing order affects directly only the handlers of a particular commodity, the members of the advisory board shall be handlers.

If the marketing order affects directly both producers and handlers of a particular commodity the advisory board shall be composed of both producers and handlers. The number of producers or handlers upon any such advisory board shall be of such number of producers or handlers as the director finds is necessary to assist properly in the administration of such order.

58843. Upon the recommendation of the advisory board, the director may appoint one person who is neither a producer nor a handler to represent the department or the public generally.
58844. A member of an advisory board is entitled to actual expenses which are incurred while engaged in performing duties that are authorized by this chapter and, with the approval of the advisory board concerned, may receive compensation not to exceed fifty dollars (\$50) per day for each day spent in actual attendance at, or traveling to or from, meetings of the board or on special assignment for the board.
58845. The director may authorize an advisory board to do all of the following:
- (a) Enter into contracts or agreements.
 - (b) Employ necessary personnel, including attorneys engaged in the private practice of law, and fix their compensation and terms of employment.
 - (c) Incur such expenses, to be paid from moneys which are collected as provided in Article 10 (commencing with Section 58921), as the director may deem necessary and proper to enable the advisory board properly to perform its authorized duties as authorized by this chapter.
 - (d) Receive, invest, and disburse funds pursuant to provisions of Article 10 (commencing with Section 58921).
58846. The duties of an advisory board are administrative only and any such board may do only the following:
- (a) Subject to the approval of the director, administer the marketing order.
 - (b) Recommend to the director administrative rules and regulations which relate to the marketing order.
 - (c) Receive and report to the director complaints of violations of the marketing order.
 - (d) Recommend to the director amendments to the marketing order.
 - (e) Assist the director in the assessment of members of the industry and in the collection of funds to cover expenses incurred by the director in the administration of the marketing order.

- (f) Assist the director in the collection of such necessary information and data as the director may deem necessary to the proper administration of this chapter.
- 58846.5 Each advisory board shall, annually, report to the members of the industry who are subject to its marketing order on the activities and program, including but not limited to, the income and expenses, the fund balance, and a report of progress in achieving program goals, of such a marketing order, as prescribed by the director.
58847. The members or alternate members of any advisory board, including employees of the advisory board, are not responsible individually in any way whatsoever to any person for liability on any contract or agreement of the advisory board.
58848. In addition to the advisory board, one or more special committees or subcommittees may be established to assist the advisory board in carrying out its duties and functions. Upon approval of the director, each advisory board may establish committees or subcommittees to carry out assigned duties and functions and designate the members or alternate members of the advisory board to serve upon such committees.
58852. It is hereby declared, as a matter of legislative determination, that the producers, or handlers, or both producers and handlers, appointed to any advisory board pursuant to this article are intended to represent and further the interest of a particular agricultural industry concerned, and that such representation and furtherance is intended to serve the public interest. Accordingly, the Legislature finds that, with respect to persons who are appointed to such advisory boards, the particular agricultural industry concerned is tantamount to, and constitutes, the public generally within the meaning of Section 87203 of the Government Code.
58895. A marketing order may contain provisions to detect, control, prevent damage by or to eradicate insects, predators, diseases, or parasites with respect to any commodity or group of commodities. The advisory board may recommend and the director may approve measures to assist in the prevention or reduction of losses to crops or livestock caused by predators, insects, disease, or parasite infestations, including the establishment and operation of detection, inspection, spraying, dusting, fumigating, or other control measures.
58921. Except as otherwise provide in section 58926, each marketing order which is issued pursuant to this chapter shall provide for the levying and collection of assessments in sufficient amounts to defray the necessary expenses which

are incurred by the director in the formulation, issuance, administration, and enforcement of the marketing order. If the marketing order authorizes the carrying out of advertising and sales promotion plans, it shall also provide for the levying and collection of assessments in sufficient amounts to defray the expenses of such activities.

58922. Each marketing order shall indicate the maximum rate of any assessment which may be collected and the proportion, if any, of each assessment which is payable by each producer and handler that is directly regulated or affected by such marketing order.
58924. The amount of the assessment for necessary expenses shall not, however, exceed the following:
- (a) In the case of producers, 2 1/2 percent of the gross dollar volume of sales of the commodity which is affected by all such producers regulated by such marketing order.
58929. Any assessment which is levied as provided in this article, in such specified amount as may be determined by the director pursuant to this chapter, is a personal debt of every person so assessed and shall be due and payable to the director if payment is called for by the director. If a person fails to pay any such assessment upon the date which is determined by the director, the director may file a complaint against such person in a state court of competent jurisdiction for the collection of the assessment.
58931. If any producer or handler that is duly assessed pursuant to the provisions of this chapter fails to pay to the director the amount so assessed on or before the date which is specified by the director, the director may add such unpaid assessment an amount not exceeding 10 percent of such unpaid assessment to defray the cost of enforcing the collection of such unpaid assessment. In addition to such payment for the cost of enforcing such collection, any such producer or handler shall pay to the director a penalty fee of 5 percent for each 30 days of the unpaid balance for each 30 days the assessment is unpaid, prorated over the days unpaid, commencing 30 days after the notice has been given to such producer or handler of his failure to pay the assessment on the date required, unless the director determines, to his satisfaction, that such failure to pay is due to reasonable cause beyond the producer's or handler's control. Such penalty shall not exceed 50 percent of the total amount of the assessment due.
58936. The director may adopt rules and regulations with respect to the assessment and collection of funds pursuant to this article.

APPENDIX F-6

Definitions

(Food and Agriculture Code)

11408. "Agricultural use" means the use of any pesticide or method or device for the control of plant or animal pests, or any other pests, or the use of any pesticide for the regulation of plant growth or defoliation of plants. It excludes the sale or use of pesticides in properly labeled packages or containers which are intended for any of the following:
- (a) Home use
 - (b) Use in structural pest control.
 - (c) Industrial or institutional use.
 - (d) The control of an animal pest under the written prescription of a veterinarian.
 - (e) Local districts or other public agencies which have entered into and operate under a cooperative agreement with the Department of Public Health pursuant to section 2426 of the Health and Safety Code, provided that any exemption under this subdivision is subject to the approval of the director as being required to carry out the purposes of this division.

(California Code of Regulations)

6000.3 Permit System: Definitions.

This section shall become effective January 1, 1981.

- (a) "Time specific" means a pesticide permit that specifies the date the intended application is to commence or a permit with a notice of intent requirement. The pesticide use may commence within four days following such date if delays are caused by uncontrollable conditions such as adverse weather or unavailability of equipment. The commissioner shall require a notice of intent from either the grower, the grower's authorized representative, or the pest control operator when necessary to make the permit time and site specific.
- (b) "Site specific" means a pesticide permit that identifies the specific area to be treated, the size of that area, and the commodity(ies) or site(s) on that area to be treated.
- (c) "Authorized representative" means an employee of the person responsible for making decisions regarding the general operation of the property or a licensed pest control adviser who has written authorization from such person to act on his or her behalf.
- (d) "Notice of Intent" means oral or written notification to the commissioner, as specified by the commissioner, prior to the use of pesticide pursuant to a permit.
- (e) "Pest Management Guides" are manuals prepared by the Department or University of California that include pest

management information on specific crops and which have been adopted as a standard by the director.

- (f) "Restricted materials hazard chart" means a chart developed by the department that specifies the degree of potential hazard for each restricted material to public and occupation health, adverse impact on pest management systems, users of restricted materials, farm workers, bees, nontarget plants, fish and wildlife, and other parts of the environment.
- (g) "Pesticide safety information series" means a series of leaflets that summarize health and safety aspects of various pesticides and groups of pesticides.

6110. Public Reports.

- (a) When the director proposes to amend, adopt, or repeal a standard or regulation pursuant to Section 11503 of the Food and Agricultural Code, a public report shall be prepared allowing 45 days for the public to review each proposal. The public report shall be posted on the official bulletin boards of the Department, and of each commissioner's office, and in each District office of the Division of Pest Management, Environmental Protection and Worker Safety for 45 days. "Standard", as used in this article, means pest management guidelines, restricted materials hazard chart, pesticide safety information series, and similar documents.

6116. Notice of Final Decision.

- (a) (1) The final action taken regarding a standard or regulation in which a significant adverse environmental point was raised during the evaluation process shall include a written evaluation of such points approved by the director.
(2) The director shall not adopt a standard or regulation which would cause a significant adverse environmental impact if there is a feasible alternative or feasible mitigation measure available which would substantially lessen any significant adverse impact which implementation of the proposal may reasonably be expected to have on the environment.
- (b) After adopting a standard or regulation affecting the pesticide regulatory program, the director shall file a Notice of Decision with the Secretary of the Resources Agency for posting. The notice shall be available for public inspection, and remain posted for a period of 30 days at the Resources Agency.

6260. Authorization for Research

With the exemption of those persons exempted by section 6261, a written authorization for research shall be obtained from the director prior to any experimental, unregistered use of an economic poison. This authorization may be terminated or amended whenever the director determines that continuation of the research may involve a hazard to the public health or the environment, that the research is used for purposes unrelated to economic poison data development or that violations of Divisions 6 or 7 of the Food and

Agricultural Code have occurred in connection with such research.

6417. Research Authorization for Ground Water Protection List
Chemicals.

Notwithstanding the provisions of this group, the director may authorize specific applications of pesticides containing chemicals listed in section 6800(a) in the Pesticide Management Zones specified in section 6802 for the purposes of research and experimentation. Any person wishing to conduct such research or experimentation shall apply to the Director by submitting a completed "Research Authorization - Pesticide Form", a sample of which is set forth in section 6264.1. In addition to the information requested on the form, the applicant shall list the name of the chemical(s) in item 2(a) and list the Pesticide Management Zone(s) in item 6.

CALIFORNIA OFFICE OF ADMINISTRATIVE LAW
SACRAMENTO, CALIFORNIA

In re:)	DECISION OF DISAPPROVAL
)	OF REGULATORY ACTION
AGENCY: Department of Food and)	(Gov. Code, sec. 11349.3)
Agriculture)	
)	OAL File No. 90-0119-05
REGULATORY ACTION: Adoption of)	
Section 6808, Titles 3 and 26,)	
California Code of Regulations.)	

SUMMARY OF REGULATORY ACTION

On January 17, 1990, the Department of Food and Agriculture defined "root zone of the crop" and "soil microbial zone" for purposes of the Pesticide Contamination Prevention Act (Statutes of 1985, chapter 1298). This action would add section 6808 to Titles 3 (Food and Agriculture) and 26 (Toxics), California Code of Regulations. On January 19, 1990, the Department submitted this action to the Office of Administrative Law for review.

DECISION

On January 20, 1990, the Office of Administrative Law notified the Department of the disapproval of this action for non-compliance with the "Necessity" and "Consistency" standards. This decision details the reasons for disapproval.

ISSUES PRESENTED

1. Whether the record contains substantial evidence of the need for the definition of "root zone of the crop" and "soil microbial zone."
2. Whether the definition of "root zone of the crop" and "soil microbial zone" are consistent with definition of "soil microbial zone" and the meaning of "root zone of the crop."

DISCUSSION

By this action the Department of Food and Agriculture proposes to implement a portion of the Pesticide Contamination Act of 1985 (Statutes of 1985, chapter 1298). The act was intended to prevent further pesticide pollution of groundwater (Subdivision (g), Food and Agriculture Code section 13141). The particular section being implemented in this action establishes a test for determining when a pesticide registration will be reviewed

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because of the presence of the pesticide or its residue in soil (Food and Agriculture Code section 13149).

This action would define "root zone of the crop" and "soil microbial zone" as those terms are used in section 13149, which provides:

"(a) Within 90 days after an economic poison is found under any of the conditions listed in paragraph (1), (2), or (3), the director shall determine whether the economic poison resulted from agricultural use in accordance with state and federal laws and regulations, and shall state in writing the reasons for the determination.

"(1) An active ingredient of an economic poison has been found at or below the deepest of the following depths:

"(A) Eight feet below the soil surface.

"(B) Below the root zone of the crop where the active ingredient was found.

"(C) Below the soil microbial zone.

"(2) . . ." [Emphasis added].

Subdivision (1) of section 13142 of the Act contains a definition of "soil microbial zone."

"For the purposes of this article, the following definitions apply: . . .

"(1) 'Soil microbial zone' means the zone of the soil below which the activity of microbial species is so reduced that it has no significant effect on pesticide breakdown."

There is no definition of "root zone of the crop" in the Act, nor in associated law.

The submitted action defines "root zone of the crop" and "soil microbial zone" to have the same meaning. The meaning selected is somewhat like, but different in significant ways, from the statutory definition of "soil microbial zone."

The submitted action provides:

"For the purpose of section 13149(a) of the Food and Agriculture Code, the root zone of the crop and the soil microbial zone shall be considered to extend from the soil surface down to the upper boundary of the C horizon of the soil.

"A soil horizon is a layer of soil approximately parallel to the land surface that differs from adjacent layers in physical, chemical, and biological properties such as color, structure, texture, consistency, kinds and numbers of

organisms present, and the degree of acidity or alkalinity. The C horizon is the layer of mineral soil above bed rock that is relatively little affected by the soil forming processes such as the activity of organisms that have a significant effect on the formation of soil horizons that may be found above the C horizon."

General:

The Office of Administrative Law reviews regulations adopted and submitted to it for publication in the California Regulatory Code Supplement and for transmittal to the Secretary of State and makes determinations using the six substantive standards of subdivision (a), Government Code section 11349.1.

In reviewing regulations the office restricts its review to the regulation and the record of the rulemaking proceeding. The office approves the regulation or order of repeal if it complies with the standards set forth in section 11349.1 and it was adopted within the procedures of the Administrative Procedure Act.

1. "Necessity:" The record of the rulemaking proceeding does not contain substantial evidence of the need for the definition of "root zone of the crop" and "soil microbial zone" submitted by the Department.

One of the standards of section 11349.1 is "Necessity." For the purposes of the Administrative Procedure Act:

"'Necessity' means the record of the rulemaking proceeding demonstrates by substantial evidence the need for a regulation. For purposes of this standard, evidence includes, but is not limited to, facts, studies, and expert opinion."

Root Zone of the Crop

No definition of "root zone of the crop" appears in the underlying statute. The Department identified "Soil Science Society of America, 1987, Glossary of Soil Science Terms, Soil Sci.Soc.Amer., Madison, WI, as a document relied upon, and it contains a definition of the term "rhizosphere."

"'Rhizosphere'-- The zone of soil immediately adjacent to plant roots in which the kinds, numbers, or activity of microorganisms differ from the bulk of the soil."

This definition does not mention soil formation, pesticide breakdown, nor the kind, number, or activity of microorganisms. It simply indicates that the zone is immediately adjacent to

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plant roots, and that the microorganism population is different from that outside the zone.

The definition of "root zone of the crop" submitted by the agency excludes any dependence upon the particular crop which might be grown on the land, or the presence of roots.

The material included in the file supports the contention that the submitted definition is a reasonable interpretation of the term root zone, in that it indicates that this is a zone in which roots might reasonably be expected to grow. There is indication that microbial activity is highest in the vicinity of plant roots. There is indication that few roots penetrate below the top of the "C horizon." There is no significant material on the depth roots or of the rhizosphere varying from the surface of the soil to the "C horizon."

However, the term used in the statute and being interpreted in the submitted action is "root zone of the crop;" and, the file does not contain substantial evidence that the "root zone of the crop" can be reasonably interpreted without reference to the crop. The closest definition provided requires the presence of roots.

It may be that evidence can be added to the file which will demonstrate that the "root zone of the crop" is in fact the same as the zone above the "C Horizon;" however, the material in the file at this time suggests the opposite. There appear to be some extremely deep delta soils in which the root zone of a shallow rooted crop might not reach the depth of the "C horizon," and it appears that some crop roots (alfalfa) have significant activity at 25 feet. It also appears that in some soils the "C horizon" exists at the surface of the ground. There is no indication that in these soils the "root zone of the crop" is not deeper than the top of the "C horizon." While it is true that until pesticides are found at a depth below eight feet the "root zone of the crop" cannot come into effect, there is no evidence that the zone will not extend below eight feet.

For the above reason, the submitted language as it defines the term "root zone of the crop" does not comply with the "Necessity" standard of subdivision (a)(1), Government Code section 11349.1.

Soil Microbial Zone

"'Soil microbial zone' means the zone of the soil below which the activity of microbial species is so reduced that it has no significant effect on pesticide breakdown."
(Subdivision (1), Food and Agriculture code section 13142.)

The submitted action interprets "soil microbial zone" to mean:

"from the soil surface down to the upper boundary of . . . the layer of mineral soil above bed rock that is relatively little affected by the soil forming processes such as the activity of organisms that have a significant effect on the formation of soil horizons that may be found above [that layer]."

No material in the file supports the critical issue of whether the change in levels of activity of microbial species having a significant impact on pesticide breakdown occurs at the same depth as the change in levels of activity of microbial species having a significant effect on soil formation.

For the above reasons, the submitted action does not comply with the "Necessity" standard of Subdivision (a)(1), Government Code section 11349.1.

2. "Consistency:" The submitted definition of "root zone of the crop" and "soil microbial zone" is not consistent with the definition of "soil microbial zone" at subdivision (1), section 13142, Food and Agriculture Code, nor with the meaning of the term "root zone of the crop."

"Consistency" is another of the six standards of subdivision (a), Government Code section 11349.1.

"Consistency" means being in harmony with, and not in conflict with or contradictory to, existing statutes, court decisions, or other provisions of law."

As discussed above under "Necessity," the Legislature established as a test "the root zone of the crop." The Department has disregarded this test, particularly in its reference to "the crop," in favor of one which will be easier to administer, the "C horizon" test. It may be that the Department can add to the record factual evidence that the "root zone of the crop" is not shallower, nor deeper than, the "C horizon;" however, that evidence is not in the record at this time.

Also as discussed under "Necessity," the Legislature established as a test the concept of "soil microbial zone," and defined the term with reference to the activity of microorganisms having a significant effect on the breakdown of pesticides. The Department has disregarded this "performance" oriented standard in favor a less directly related standard based on, among other things, the activity of microorganisms having an effect on soil formation processes. It may be that the Department can add to the record factual evidence that the depth to which soil formation processes take place is the same as the depth to which

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February 26, 1990

activity of microorganisms having a significant effect on
pesticide breakdown take place.

In the absence of substantial evidence in the record that the upper boundary of the "C horizon" is the same as the lower boundary of the "root zone of the crop;" and, in the absence of substantial evidence in the record that the upper boundary of the "C horizon" is the same as the lower boundary of microorganism activity having a significant effect on pesticide breakdown; the submitted language substitutes the judgment of the Department for that of the Legislature in determining the appropriate depths for triggering re-review of pesticide registration.

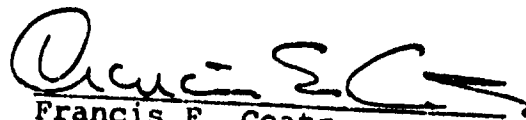
For the above reason, the submitted action does not comply with the "Consistency" standard of subdivision (a)(4), Government Code section 11349.1.

Note: To the extent that the Department can marshal evidence to cure the problems identified in this decision, that material may be added to the rulemaking record subject to compliance with subdivision (d) of Government Code section 11346.8 and California Code of Regulations, title 1, section 45. The file could then be resubmitted without re-noticing under Government Code section 11346.4 and without an additional oral public hearing. If the Department decides to continue to rely on the original notice of August 18, 1989, then the file must be resubmitted to this office within one year of that date. If the file is not submitted within one year of August 18, 1989, then the agency will have to restart the formal rulemaking process.

Conclusion:

For the above reasons the Office of Administrative Law has disapproved this rulemaking action.

Dated: February 23, 1990


Francis E. Coats
Staff Counsel
For: Linda Brewer
Director

Original: Mark Pepple
cc: Rex Magee

DEPARTMENT OF FOOD AND AGRICULTURE

1220 N Street
Sacramento
95814

NIPM Item #12
Rev. 02-01-87



Approved Treatment and Handling Procedures to Ensure Against Nematode
Pest Infestation for Fruit and Nut Tree, Grapevine, Berry, Vegetable
Plant, Kiwi, and Other Nursery Stock for Farm Planting

In accordance with the terms of the Regulation for Nursery Inspection, the Department of Food and Agriculture hereby specifies soil treatments and handling procedures which, when supervised and documented by the County Agricultural Commissioner, are approved to assure nematode cleanliness of both field and container grown nursery stock. These procedures expressly are not aimed at control of soil pathogens, weeds or other soil-borne pests.

FIELD GROWN FRUIT AND NUT TREE, GRAPEVINE, BERRY,
VEGETABLE PLANT, AND KIWI NURSERY STOCK

SOIL PREPARATION IS THE MOST IMPORTANT FACTOR AFFECTING SUCCESS OF FUMIGATION. Inspections shall be made by the County Agricultural Commissioner to determine that all of the following requirements for pre-treatment preparation, treatment, and post-treatment handling of soils have been met:

1. Trash removal. Trash (crowns, stems, roots) from the previous crop must be removed as completely as possible, so that as little as possible plant tissue remains to harbor nematodes during the waiting period. The land should then be thoroughly disced to reduce the size of trash which cannot be physically removed, so that it will decompose before fumigation. The waiting period may not begin until the foregoing has been accomplished to the Commissioner's satisfaction. Treatment of land for which trash removal has not been effected cannot be approved.
2. Waiting period. A noncrop, clean-fallow waiting period should be provided, after trash removal and before fumigation, as follows:
 - a. Not less than 24 months following removal of an orchard or vineyard that has been in place for more than one year;
 - b. Not less than 9 months following removal of a previous woody nursery crop which has been in place for more than one year;
 - c. Not less than 6 months following removal of a nematode host crop (including seedling or June-budded fruit trees, grapevines or strawberry nursery stock, cotton, or alfalfa) which has been in place for less than one year;
 - d. No waiting period is required for annual vegetable plants, provided that the vegetable crop trash is removed prior to soil treatment.

5. Application methods.

- a. Dual application. Apply the first treatment by injecting the chemical at a minimum depth of 14 inches (35.5 cm) at a chisel spacing equal to the depth; of 12 to 14 inches (30.5 to 35.5 cm); wait a minimum of 10 days, turn the top soil layers under with a plow after this period or at just prior to the time of the second treatment. Apply the second treatment by injecting the chemical at the 8-10 inch (20-25 cm) depth at a chisel spacing of 12 inches (30.5 cm). Seal the surface with a ring roller immediately after each application. Wait at least 10 days following treatment before disturbing soil.
- b. Tarpping. Tarpping refers to the post-application sealing of soil with plastic tarpaulins of not less than one mil thickness. Two methods may be used to accomplish a complete coverage of the production area. "Solid tarping" accomplishes coverage in one step using equipment which glues together the overlapping edges of the plastic strips. The outside edges are buried at least 6 inches (15 cm) deep.

"Strip tarping" is used in a two-step soil treatment. Soil strips approximately 12 feet (3.7 meters) wide are fumigated and mechanically covered with a plastic tarpaulin all edges of which should be buried at least 6 inches (15 cm). These strips are alternated with untreated, untarped strips about 10 feet (2.8 meters) wide. After 48 hours the tarps are removed from the treated soil strips, and treatment and tarping are applied to the alternate and previously untreated strips.

Methyl bromide and methyl bromide/chloropicrin formulations (mixtures) should be injected at a depth of 6-10 inches (15-25 cm) on a 12 inch (30.5 cm) spacing, with the total dosage applied at one time. D.D and Telone II should be injected at a depth of 14 inches (35.5 cm) and at a chisel spacing of 12 to 14 inches (30.5 to 35.5 cm), with the total dosage applied at one time. Apply tarps simultaneously with treatment or immediately following, and leave in place for at least 48 hours.

6. Any lot of rooted nursery stock which does not bear a valid California Nursery Stock Certificate must be sampled (see Nursery Inspection Procedures Manual, Item #16) and inspected using approved laboratory techniques, and found to be free of nematode pests, before the stock may be planted in land treated in this approved manner.
7. Nursery stock, including cuttings, produced in accordance with these approved procedures shall be stored, healed-in, or calloused in media, beds or storage areas approved by the County Agricultural Commissioner. The Commissioner may require such treatment as may be necessary to protect against nematode infestation.

Schedule B. Schedule B treatments are approved only for properties on which at least two field-grown crops have been produced, for each of which: (1) approved soil treatment to assure against nematode infestation has been applied; or (2) no nematode infestation has been detected using laboratory methods; and (3) nothing during the interval between crops has exposed the property to nematode infestation.

This dosage schedule is for nematode control only. It is not recommended for control of soil-borne pathogens such as phytophthora fungi. Treatment recommendations for the latter should be obtained direct from your local Farm Advisor.

<u>Material</u>	<u>DOSAGE PER ACRE (HECTARE) (1)</u>		<u>Application Method</u>
	<u>Sandy Soils</u>	<u>Clay Loam Soils</u>	
Methyl bromide (2) (actual CH ₃ Br)	300 lbs. (336 kg)	400 lbs. (448 kg)	Tarping (4)
Telone II (3)	<u>Application #1</u>	<u>Application #1</u>	Dual Application
	<u>35 gals. (328 liters)</u>	<u>55 gals. (515 liters)</u>	
	<u>Application #2</u>	<u>Application #2</u>	Single Application/Tarping (4)
	<u>15 gals. (141 liters)</u>	<u>15 gals. (141 liters)</u>	
	<u>50 gals. (466 liters)</u>	<u>70 gals. (655 liters)</u>	

- (1) One pound per acre equals 1.12 kg. per hectare. One gallon per acre equals 9.35 liters per hectare.
- (2) Formulations (mixtures) of methyl bromide and chloropicrin may be used provided that the actual amount of methyl bromide does not drop below the amounts shown in this schedule.
- (3) Two treatments are required. Application is to be made as described in Item 5a of these procedures.
- (4) Tarping shall be as described in Item 5b of these procedures.

Schedule D. Schedule D treatment may be used instead of schedules A, B or C at lower dosages where appropriate soil moistures, soil textures, and soil temperatures allow. If soil conditions are such that schedule "D" cannot be used, the appropriate schedule A, B or C must be used. See Chart I-VI.

Procedure for Schedule D

A = Tare Weight
B = Fresh Soil Weight
C = Dry Soil Weight
D = Difference
E = Dry Weight Minus Tare
F = % Soil Moisture

Procedures for Selection of Treatment Rates and Methods

1. Use local experience or a soils map to locate the site where highest soil moisture is expected. The wettest site almost always is of finer texture or has a hard pan layer within the soil profile.
2. Take soil samples at each 12-inch increment down to 5 foot depth. Sub samples are not necessary. Place each soil sample (pint each) into a moisture tight container. Seal and label according to site and depth. Determine, by the feel method, the soil texture at each depth and record on the data sheet.
3. Take a temperature reading at 12-inch depth only. Allow 5 minutes to equilibration. Record on the data sheet.
4. Now select an area of the field which you estimate is representative of the nursery site relative to field moisture. Repeat steps 2 and 3 above and record data.
5. At the location of the scales and microwave oven, mix each soil sample and place 100 to 150 grams of soil into each weighing dish. Weigh immediately, record weights and place into oven with lids off. The 10 soil samples can be dried simultaneously. A vessel of open water should not be placed in the oven when using a modern microwave oven. The oven should be run at high range for 15 minutes (650 watt).
6. Once oven-dried samples are allowed to sit in the open they will begin to collect moisture from the atmosphere. Therefore, quickly remove each weighing dish and weigh. Record dry weights.
7. Calculate the difference in weight loss ($B - C = D$).

Chart I - Protection for a 26 month crop: Methyl Bromide with high barrier tarp such as HBF-1
(add 100 lb. MB for conventional tarp such as LDPE)

Temperature	5 to 25°C					10 to 20°C	
Soil Moisture	Sand	Loamy Sand	Sandy Loam	Loam	Clay Loam	Clay	
2 to 6%	200						
3 to 8%		200					
4 to 10%							
10 to 12%			200				
6 to 14%				300			
14 to 18%				400			
8 to 12%					300		
12 to 18%					350		
18 to 22%					400		
15 to 22%						400	
22 to 35%						500	

TOO DRY

TOO WET

Numbers indicate the pounds per acre of methyl bromide. Moisture shall be the highest soil moisture in the top five feet of soil.

Chart III - Protection of a 26 month crop. Telone II, not flipped, followed within 10 to 21 days with 20 gallon Metham rototilled into the top 4 inches or sprinkled in with 3 inches water.

Temperature	5 to 25°C		10 to 25°C		15 to 20°C	
	Sand	Loamy Sand	Sandy Loam	Loam	Clay Loam	Clay
2 to 6%	40					
3 to 8%		40				
4 to 8%			40			
8 to 12%			50			
6 to 14%				50		
14 to 18%				60		
8 to 12%					60	
12 to 18%					70	
18 to 22%					80	
15 to 22%						80

Numbers indicate the gallons of Telone II (94% 1,3, Dichloropropene) to apply per acre at 12 inch depth and no more than 18 inch chisel spacing. Treatment followed by ring roller or compaction device.

Moisture shall be the highest soil moisture in the top five feet of soil.

Chart V - For protection for a 14-month crop. Telone II, not flagged, followed by 1 pound actual ingredient Nemacur (Fenamiphos) or Vydate (Oxamyl) monthly through emitter tubing with 12 inch or less emitter spacings (drip irrigation).

Temperature	5 to 25°C		10 to 25°C		15 to 20°C	
Soil Moisture	Sand	Loamy Sand	Sandy Loam	Loam	Clay Loam	Clay
2 to 6%	20					
3 to 8%		20				
4 to 9%			20			
9 to 12%			20			
6 to 9%				20		
9 to 14%				30		
14 to 18%				40		
8 to 12%					30	
12 to 18%					40	
18 to 22%					50	
15 to 35%						50

TOO DRY

TOO WET

Numbers indicate the gallons of Telone II (94% l, l, Dichloropropene) to apply per acre at 12 inch depth and no more than 18 inch chisel spacing. Treatment followed by ring roller or other compaction device.

Moisture shall be the highest soil moisture in the top five feet of soil.

It is not necessary to apply monthly applications of Nemacur and Vydate until the crop planted and the soil temperature exceeds 14°C at a depth of 12 inches.

NURSERY SITE SOIL CONDITIONS - PRETREATMENT

Site Depth	Temperature	Texture	Soil Moisture Content					
			Wt. Tare A	Fresh Soil Wt. B	Dry Soil Wt. C	Difference D	Dry Wt. - tare E	Soil Moisture F
1'	<u>°C</u>							
2'								
3'								
4'								
5'								
Wettest								
1'	<u>°C</u>							
2'								
3'								
4'								
5'								
Driest								

G-8

SOIL TEXTURAL CLASS CHARACTERISTICS

The following are suggestive only and all may not occur with any particular soil because of differences in clay type, organic matter content, exchangeable cation ratios, or amount of soluble salts present.

SAND OR LOAMY SAND: Dry-Loose, single grained; gritty; no or very weak clods. Moist-Gritty; forms easily crumbled ball; does not ribbon. Wet-Lacks stickiness, but may show faint clay stainings (loamy sand especially). Individual grains can be both seen and felt under all moisture conditions.

SANDY LOAM: Dry-Clods break easily. Moist-Moderately gritty to gritty; forms ball that stands careful handling; ribbons very poorly. Wet-definitely stains fingers; may have faint smoothness or stickiness, but grittiness dominates. Individual grains can be seen and felt under nearly all conditions.

LOAM: This is the most difficult texture to place since characteristics of sand, silt, and clay are all present but none predominates. Suggests other textures. Dry-Clods slightly difficult to break; somewhat gritty. Moist-forms firm ball; ribbons poorly; may show poor fingerprint. Wet-Gritty; smooth, and sticky all at same time. Stains fingers.

SILT OR SILT LOAM: Dry-Clods moderately difficult to break and rupture suddenly to a floury powder that clings to fingers; shows fingerprint. Moist-Has smooth, slick, velvety, or buttery feel; forms firm ball; may ribbon slightly before breaking; shows good fingerprint. Wet-Smooth with some stickiness from clay; stains fingers. Grittiness of sand is well masked by other separates. (Texture most likely SILT LOAM, there are a few SILT soils).

SANDY CLAY LOAM: Dry-Clods break with some difficulty. Moist-Forms firm ball that dries moderately hard; forms $\frac{1}{2}$ " ribbons that hardly sustain own weight; may show poor to good fingerprint. Wet-Grittiness of sand and stickiness of clay about equal, masking smoothness of silt; stains fingers.

CLAY LOAM: Dry-Clods break with difficulty. Moist-Forms firm ball that dries moderately hard; ribbons fairly well, but ribbons barely support own weight; shows fair to good fingerprint. Wet-Moderately sticky with stickiness dominating over grittiness and smoothness; stains fingers.

SILTY CLAY LOAM: Resembles SILT LOAM but with more stickiness of clay. Dry-Clods break with difficulty. Moist-Shows a good fingerprint; forms a firm ball drying moderately hard; ribbons $\frac{1}{2}$ "-1" that can be fairly thin. Wet-Stains fingers; has sticky-smooth feel with little grittiness of sand.

SANDY CLAY: Dry-Often cloddy, clods broken only with extreme pressure. Moist-Forms very firm ball, drying quite hard; shows fingerprint; squeezes to thin, long, somewhat gritty ribbon. Wet-Stains fingers; clouds water; usually quite sticky and plastic, but has some grittiness present.

SILTY CLAY: Dry-See SANDY CLAY. Moist-Forms very firm ball becoming quite hard on drying; shows fingerprint; squeezes out to a thin, long, smooth ribbon. Wet-Stains fingers, clouds water, stickiness dominates over smoothness, grittiness is virtually absent.

CLAY: Dry-Cloddy, clods often cannot be broken even with extreme pressure. Moist-Forms firm, easily molded ball drying very hard; squeezes out to a very thin ribbon 2-3" long. Wet-Stains fingers, clouds water; usually very sticky with stickiness masking both smoothness and grittiness; wets slowly.

DEPARTMENT OF FOOD AND AGRICULTURE

Pest Exclusion/Nursery Programs
1220 N Street
Sacramento, CA 95814



SAMPLING PROCEDURE AND TECHNIQUES FOR DETECTION
OF NEMATODES BY LABORATORY EXAMINATION

In accordance with the terms of the Regulation for Nursery Inspection, the Department of Food and Agriculture hereby specifies sampling requirements and procedures for detection of nematode pest infestations in field, container, flat, and frame grown nursery stock.

Where inspection for the detection of nematodes using laboratory methods is a requirement, sampling procedures shall be as follows:

1. Field grown nursery stock - generally. Collect root samples before digging time on a 40-foot (12 meter) grid interval throughout the planting. To assure detection of dagger nematodes, root samples should include a small amount of the soil adhering to or along the feeder roots collected at each point. Samples may be composited on an acre (0.4 hectare) basis. Root and soil samples should be processed and examined separately.
2. Field grown nursery stock - special case. At the discretion of the commissioner, root samples may be collected on an 80-foot (24 meter) grid interval and composited on a two-acre (0.8 hectare) basis when both of the following conditions have been met:
 - a. The growing ground has been fumigated at not less than 1,3-D hydrocarbon or methyl bromide product labeled rates for the kind of farm planting nursery stock being produced.
 - b. No plant parasitic nematodes have been found either by laboratory or field inspection procedures in the previous two successive nursery crops on the growing ground.
3. Container, flat, and frame grown nursery stock. A composite sample from each lot is to be obtained by collecting roots from one plant in every 100 square feet (9 square meters) of bench or frame space. Care should be exercised to keep the lots down to logical and practical sizes.
4. Delimitation of nematode pests found in any planting may be made only as provided in the Nursery Inspection Regulation,

MEMORANDUM OF UNDERSTANDING
BETWEEN THE
SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
AND THE
STATE WATER RESOURCES CONTROL BOARD
FOR
PLANNING AND TECHNICAL ASSISTANCE RELATED TO
WATER QUALITY POLICIES AND ACTIVITIES

I. PURPOSE:

The purpose of this Memorandum of Understanding (MOU) is to formalize cooperation between U.S. Department of Agriculture (USDA), Soil Conservation Service (SCS) and the State Water Resources Control Board (State Board), and to develop appropriate guidelines and procedures related to water quality activities. The SCS and State Board share a common interest in maintaining, protecting, and improving the quality of waters (surface and ground water) of the State.

Through this MOU, the State Board seeks to utilize the personnel and expertise of SCS to increase the assistance available to California in the development and implementation of water quality programs and projects. Coordination and cooperation between SCS and State Board will reduce unnecessary duplication of effort, accelerate the implementation of best management practices (BMPs) and other nonpoint source (NPS) measures, and increase overall program effectiveness.

II. AUTHORITIES:

This MOU is entered into under the authorities of the Soil Conservation and Domestic Allotment Act (16 U.S.C. Section 590-f), as amended, Division 7 of the California Water Code (Porter-Cologne Act), and the authorities of the Clean Water Act (CWA), [Section 304(1), 314, 319, and 320], as amended.

Nothing in this MOU alters the statutory or regulatory authority of SCS or the State Board. This MOU is intended to strengthen those statutory requirements through the development of cooperative federal-State efforts.

III. BACKGROUND:

USDA Regulation 9500-7, Nonpoint Source Water Quality Policy, December 5, 1986 and USDA Regulation 9500-8, Policy for Groundwater Quality, November 9, 1987 established policy for integrating surface and ground water quality protection and improvement into the appropriate programs and activities.

The report to the Congress by the Secretary of Agriculture in the National Program for Conservation of Soil and Water: The 1988-90 Update gives top priority to the solution of soil erosion on agricultural land. The second priority is the "protection of the quality of surface and ground water from harmful contamination from nonpoint sources".

V. STATE BOARD AGREES TO:

- A. Use the SCS Field Office Technical Guide as a resource reference in the development and implementation of BMPs.
- B. Assist the SCS in the selection of priority hydrologic units for the implementation of water resource projects.
- C. Jointly develop with the SCS and CARCD demonstration projects addressing water quality concerns.
- D. Encourage the voluntary or cooperative approach as the first step in the development and implementation of solutions to the NPS problem.
- E. Consider the development of a statewide water quality policy for reducing NPS pollution of surface and ground waters and achieving water quality standards by working with other agencies.
- F. Coordinate the activities of the California Regional Water Quality Control Boards with those activities being proposed and implemented by the SCS.
- G. Define the goals and objectives of the NPS Interagency Advisory Committee and conduct regular meetings.

VI. SCS AND STATE BOARD MUTUALLY AGREE TO:

- A. Develop a process for BMP selection and implementation to reduce or prevent agricultural pollution in priority waterbodies.
- B. Continue to upgrade and update the SCS's Field Office Technical Guide and BMPs as new technology is developed.
- C. Develop agricultural BMPs for NPS pollution control with input from the NPS Interagency Advisory Committee, and others.
- D. Develop implementation priorities and policies for NPS pollution activities.
- E. Provide guidance and technical assistance to implementation agencies.
- F. Encourage participation of other federal, State, and local agencies in the control of NPS pollution.

VII. OTHER CONDITIONS OF THE MOU:

- A. This is not a fiscal or a funds obligation document. Endeavors involving reimbursements or transfer of funds between SCS and the State Board for the purposes of this Agreement will be in accordance with USDA/SCS and State Board financial procedures. Any reimbursement agreement will be contingent upon the availability of funds and upon limitations of appropriations authorized by law.

**MEMORANDUM OF UNDERSTANDING
BETWEEN THE
STATE WATER RESOURCES CONTROL BOARD
AND THE
CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE
FOR THE PROTECTION OF
SURFACE WATER QUALITY FROM POTENTIAL
ADVERSE EFFECTS OF PESTICIDES**

BACKGROUND

The State Water Resources Control Board (State Board) and the California Department of Food and Agriculture (CDFA) have responsibilities relating to the protection of surface water quality from the potentially adverse effects of pesticides. Both agencies believe that the State will benefit by a unified and cooperative program to address surface water quality problems related to the use of pesticides.

The purpose of this Memorandum of Understanding (MOU) between the State Board and CDFA is to ensure that pesticides registered in California are used in a manner that protects surface water quality and the beneficial uses of water while recognizing the need for pest control.

The Food and Agricultural Code, as reaffirmed by the Governor's Executive Order D-15-83, charges CDFA with the responsibility of ensuring the orderly regulation of pesticides while protecting the quality of the total environment (including surface water quality) and the health, safety, and welfare of the public.

SCOPE

This MOU is intended to assure that the respective authorities of the State Board and CDFA, relative to the protection of surface water quality and beneficial uses from impairment by the use of pesticides, will be exercised in a coordinated and cohesive manner designed to eliminate overlap of activities, duplication of effort, and inconsistency of action. To that end, this MOU establishes principles of agreement regarding activities of the signatory agencies, identifies primary areas of responsibility and authority between these agencies, and provides methods and mechanisms necessary to assure ongoing coordination of activities relative to such purposes. This MOU also describes how the agencies will work cooperatively to achieve the goals of the respective agencies.

STATUTORY AUTHORITIES

The Porter-Cologne Water Quality Control Act establishes a comprehensive water quality control program for California. The federal Clean Water Act adds additional water quality control provisions to be implemented nationwide. The

be provided in an expeditious manner with minimum reporting requirements met. Reporting requirements and procedures for data referrals will be described in an implementation document.

3. Collect, exchange, and disseminate information on (a) the use of pesticides, (b) impacts on the quality of the State's surface waters from such uses, and (c) any efforts to mitigate those impacts.
4. Share information on pesticide formulations and environmental fate and toxicity of active ingredients, inert ingredients, and break-down products. Procedures to protect proprietary information will be described in an implementation document.
5. Consult each other in developing or revising water quality objectives for pesticides and in developing or revising regulations which may impact surface water quality.
6. Participate in the development of State policies, guidelines, and management plans relative to pesticide use and surface water quality control.
7. Promote the identification and development of Best Management Practices (BMPs) whenever necessary to protect the beneficial uses of the surface waters of the State from the potentially adverse effects of the use of certain pesticides or to serve as programs of implementation for pesticide-related water quality objectives in surface water quality control plans. CDFA's plans to implement BMPs, as furnished to the State Board, and/or Regional Boards should (a) describe the nature of the actions which are necessary to achieve the objectives, including recommendations for appropriate actions by any entity, public or private, (b) set a time schedule for actions to be taken, and (c) describe the points of application and the monitoring to be undertaken to determine compliance with the water quality objectives.
8. Base plans to implement BMPs initially upon voluntary compliance to be followed by regulatory-based encouragement of BMPs as circumstances dictate. Mandatory compliance will be based, whenever possible, on CDFA's implementation of regulations or permit requirements. However, the State and Regional Boards retain ultimate responsibility for compliance with water quality objectives. This responsibility may be implemented through the State and Regional Board's Basin Planning Programs or other appropriate regulatory measures consistent with applicable authorities and the provisions of the Nonpoint Source Management Plan approved by the State Board in November 1988.

State of Oregon
DEPARTMENT OF AGRICULTURE
635 Capitol St. NE.
Salem, Oregon 97310



Report No. 0232

Laboratory Services
Phone (503) 378-3793
FTS 530-3793

PESTICIDE

UNIVERSAL SAMPLE COLLECTION AND LABORATORY ANALYSIS REPORT

Requesting Agency/Division/Firm

OSDA PLANT DIVISION

Address

Telephone

8-3776

Contact Person

Bob Mitchell

Purchase Order No.

Sample No(s).

Lot/Code No(s).

Description of Sample(s)

Water

00406-1, 2, 3, 4, 5, 6

Sampled at

Brookings - Harbor area

Method of Sampling and Sample Preparation

Water samples

Plated Samples

Reason for Sampling

Ground water pesticide residues

Sample(s) collected by

Bob Mitchell (& John McLoughlin)

Date/Time collected

6-22-83 morning

Analysis Requested Telone & Temik (aldicarb)
Thimet & PCNB (Terraclor)

Received on

6-22-83

Received by

T.L.P.

Sample No.

Lab No.

Copper

Telone/D-D

Analytical Results

Temik

Thimet

PCNB (Terraclor)

00406-1

7252

0.002 liter

No residue

No residue

No residue

No residue

00406-2

7253

0.009

No residue

No residue

No residue

No residue

00406-3

7254

0.007

No residue

No residue

No residue

No residue

00406-4

7255

0.004

No residue

No residue

No residue

No residue

00406-5

7256

0.002

No residue

No residue

No residue

No residue

00406-6

7257

0.005

No residue

No residue

No residue

No residue

Analysis Completed on

6-28-83

7-1-83

Analyst

Report Sent on

7-6-83

Reviewed by

Remarks

Analysis Information



STATE OF OREGON

APPENDIX K

INTEROFFICE MEMO

TO: Bill Kosesan, Tom Harrison

DATE: June 23, 1983

FROM: Bob Mitchell *RAM*

SUBJECT: BROOKINGS-HARBOR WATER SAMPLES

It is my understanding that the California Department of Agriculture (or some other state agency) sampled Smith River and ground water in the lily-growing area of Del Norte County, and residues of aldicarb (Temik) were found as high as 29 or 30 ppb in one sample. Additionally, residues of 1, 2-dichloropropane (from D-D Soil Fumigant) were found in water. The lily-growing area extends into the Brookings-Harbor area of southern Curry County and cultural practices are the same in both locations.

John McLoughlin and Bob Mitchell obtained six water samples on June 21, 1983. These samples are listed on pesticide laboratory report No. 00406 (attached). Samples 1 and 2 are from domestic wells and 3, 4 and 6 are from irrigation wells; sample number 5 is indicative of stream drainage. A topographic map of the Harbor Bench with notations of growers' lily fields is also attached.

Pesticides which are used, or have been used, in the lily fields include: Temik, D-D, Telone, Bordeaux Mixture (15-25 applications a year), Thimet, BHC, Lindane, Ornilan, Chipco 26019, Daconil, Benlate, Terraclor (PCNB), Ferbam, Metasystox, Namacur and Vydate.

csM15D

Attachments

APPENDIX L

Well Inventory Data Base

Summary of Inquiry on December 19, 1990.

Questions: Have any well samples be taken on the North Coast bench of Del Norte County?

If so, what were the results?

Answer:

No records were selected for the following section, township and range:

T18N R01W 05, T18N R01W 08, T18N R01W 16, T18N R01W 17,
and T19N R01W 32.

Therefore, no records of any samples have been entered into the well inventory data base as of the date of inquiry.